C

JPRS-ELS-87-055 034075

21 DECEMBER 1987

FOREIGN
BROADCAST
INFORMATION
SERVICE

19981104 095

JPRS Report

Science & Technology

Europe & Latin America

10
125
A06

JPRS-ELS-87-055

21 DECEMBER 1987

SCIENCE & TECHNOLOGY

EUROPE & LATIN AMERICA

CONTENTS

/7310

MAX PLANCK INSTITUTE DEVELOPS NEW CONDUCTIVE POLYMER

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 462, 28 Aug 87 pp 9-10

[Excerpts] In cooperation with industry, the Max Planck Institute for Polymer Research in Mainz and the University of Bayreuth have developed a polyacetyl with a conductive capacity comparable to that of metal [substances]. This achievement proves that it is basically possible to make progress in the metal sector using electrically conductive polymers.

Various possible applications in electrotechnology and electronics may arise for these polymers, such as in the production of flexible electric conductors which carry small amounts of energy, in electronic circuits, and in new types of electrodes.

Electrically conductive synthetic materials have been the subject of research and development for several years now. Particularly intensive work in this field has been carried out by scientists in the United States, Japan, and the FRG.

For some time now scientific interest has focused on conductive polymers. These are substances which "originally" have a certain level of electric conductivity, and it is particularly interesting that the conductivity can be increased substantially through so-called doping [Dotierung], that is, through treatment with special oxidation and reducing agents.

The Japanese [scientist] Shirakawa developed a corresponding synthesis process as early as the mid-1970's. Using special catalysts at a temperature of minus 78 degrees C he obtained a polyacetyl foil which, after doping, reached a level of electrical conductivity equal to 200 Siemens per centimeter (S/cm), the conductive capacity of many semiconductors. However, Shirakawa's polyacetyl foil was not very stable--the electrical conductivity decreases rapidly in the presence of oxygen or humidity.

Nevertheless, a decisive breakthrough has now been made; in two projects with BMFT subsidies totaling DM45 million, researchers discovered a process that makes it possible to produce polyacetyl foils at ambiental temperature. In addition, this "new" polyacetyl has an electric conductive capacity of above 100,000 S/cm.

A decisive factor in this achievement has been the new catalyst modification. Combined with improvements in the basic process [technique], it is possible to produce a polyacetyl in which the macromolecules show a more uniform degree of orientation than in the old polyacetyls. The product can also be stretched to form a transparent film, and has a good degree of stability.

There are still many problems and questions, particularly concerning application techniques, that hinder large scale marketing of these electronically conductive polymers. However, given the satisfactory laboratory results, scientists are confident that the necessary solutions and answers will be found.

8701
CSO: 4698/M028

DEVELOPMENTS IN FRG SUPERCONDUCTOR RESEARCH REPORTED

BMFT Announces Subsidies for Superconductor Research

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 461, 23 Aug 87 pp 6-7

[Announcement: "Notification Concerning the Subsidy of Priority Research Projects in Superconductor and Low Temperature Technology in the Form of Joint Projects"]

[Text] 1. The BMFT (Federal Minister for Research and Technology) intends to subsidize applications-oriented research [by establishing] research priorities in the form of joint projects, within the framework of research subsidies for superconductors and low temperature technology.

2. Thematic priorities must concern primarily the following fields:
   - --synthesis of new superconductors;
   - --preparation and characterization of chemically stable solid material and thin films;
   - --studies aimed at acquiring a better understanding of the mechanisms of high temperature superconductivity;
   - --work on shaping and microstructuring conductive elements;
   - --improvement of specific qualities of superconductors in view of technical applications.

3. The joint projects must be interdisciplinary and include various groups or institutions. The individual contribution of each cooperative partner must be evident from the project application. Individual projects are to be included in one of the thematical priorities and an appropriate project and financial plan is to be proposed. A project leader, directly responsible to the project subsidizer, must be appointed for every joint project.

4. Research institutes and industries can participate in the joint project, the latter on condition that they contribute substantially to the expenditures of the institutes. Industrial participation in the project can take the form of a financial contribution or other forms of contribution (for example, provision of additional means and material for operation), and/or the form of a completely self-financed project.

5. Proposals for the execution of the above mentioned research and development programs, which will initially only be proposed in the form of

project summaries (especially the subproject objectives, work plan, schedule, requirements, and participants) may be sent to the project contractor until 30 September 1987.

VDI-Technologiezentrum
Physical Technologies
Graf-Recke+Sts.84
4000 Duesseldorf 1
(c/o Frau Dr Gronau)
Tel. 02 11/62 14-5 87

The project contractor will provide further information as well as technological and organizational advice.

Bonn, 23 July 1987
423--7115--9/87

Inorganic Oxides Conduct Current Without Resistance

Duesseldorf VDI-NACHRICHTEN in German No 34, 21 Aug 87 pp 18-19

[Article by Rainer Hofman; first paragraph is VDI-NACHRICHTEN introduction]

[Excerpts] VDI-NACHRICHTEN, Duesseldorf 21.8.87--Approximately 1 year ago two Swiss researchers reported a discovery worthy of the Nobel prize. They managed to produce a superconductor effect at -238 degrees C instead of at the previous temperature of -250 degrees C. Following the successful attempts at further improvements made in the meantime in the rest of the world, the U.S.A. has been making similar attempts since the beginning of this month under government subsidy. After Japan, the European Community has also responded by providing subsidies for this so-called electronic material of the next millenium. What exactly are " Zurich" alloys, and what could their hi-tech application imply?

Fifteen months ago, after years of stagnation in the search for substances with higher transition temperatures the researchers in Rueschlikon on Lake Zurich managed to prepare a material which becomes superconductive at 35K.

An authentic world race immediately began for the search of even higher temperatures. Almost daily, news of new successes arrived from the U.S.A.,

Japan, China, and also from the FRG. At present, some researchers are already discussing the possibility of achieving superconductivity at room temperature.

Hard, Brittle Ceramic Shows Puzzling Low Temperature Characteristics

As opposed to previously used materials based on the metals niobium-titanium or niobium-tin, the new materials, also known as "Zurich alloys," belong to the group of ceramics which are noted, among other things, for being electrically nonconductive at room temperature.

Renowned researchers such as Professor Constantin Politis of the nuclear research center in Karlsruhe believe these substances could change electronic engineering, and consequently our whole life; but precisely what kind of substances are they?

They are essentially a simple compound of inorganic oxides:
--alkaline-earth elements barium or strontium;
--III-B transition elements [Ubergangselemente] yttrium or lanthanium;
--some elements from the group of rare earth elements, for example neodymium, europium or dysprosium, and finally bivalent copper.

The composite undergoes temperature treatment which produces ceramic substances with partially differing crystal structures. They all show characteristics typical of the material, such as brittleness and hardness.

At the University of Houston researchers classified a complete class of combinations with the general composition: $RBa_2Cu_3O_7$, where R stands for transition elements such as yttrium or scandium and for the rare earth elements.

It was very quickly discovered not only in Houston, but also in many other laboratories throughout the world, that over the number of oxygen atoms in the above formula, the physical properties are to be changed. Therefore, if oxygen atoms are removed, the number of positively charged ions, of for example, barium, must be decreased so that the molecule outwardly remains electrically neutral.

The Number of Oxygen Ions is Decisive for the Physical Characteristics

The oxygen deficit depends both on the production temperature and on the atmosphere in which the samples are burned. Further examination showed that by decreasing the quantity of barium by approximately 15 percent it is possible to achieve both the highest transition temperature and the sharpest transition from a normal state to a superconductive condition in a temperature interval of between 1.5K and 2K.

The production of the new materials is conceptually simple: barium, lanthanium, and copper are taken in nitrate form and mixed thoroughly; the whole mixture is then dissolved and is finally precipitated as an oxalate.

The precipitate is treated at a temperature of 900 degrees C for approximately 5 hours and is then pressed into tablets at a pressure of around 4 Kbars and sintered once again at 900 degrees C. X-ray examination showed that the new "hot" superconductive phase crystallizes in the film-like structure of perovskite, a calcium-titanate mineral [composite].

In the meantime, in addition to the precipitated samples, other samples are being prepared that are mixed almost exclusively out of oxides or carbonates and then sintered at a temperature of between 900 degrees C and 1100 degrees C.

Why do ceramic materials which are usually electric insulators display superconductive characteristics? Moreover, why does this occur at these relatively high temperatures?

At the moment there is no definite explanation for the high transition temperature. The theory concerning the only substances which have been appropriate for use to date, NbTi- or Nb3Sn-superconductors, is based on spin paired electron duplets. When a certain temperature is reached, these cooper pairs move through the respective crystal lattice without friction with the lattice components. This explanation--which, moreover, was formulated 60 years after the discovery of the phenomenon of superconductivity--does not fully account for the high-temperature effect.

Pure La_2CuO_4 is a typical semiconductor. The structure consists of oxygen ctahedrons with Cu atoms in the center. The La atoms, arranged by the oxygen in a triangular form are situated among these lattice components. The substitution of trivalent lanthanium with bivalent barium or strontium leads to a charge deficit which can only be compensated by partial oxidation of Cu (II) to form Cu (III), or by the appearance of oxygen vacancies [Leerstelle]. As the temperature decreases, a phase transition of the originally tetragonal crystal lattice to form an orthorhombic structure occurs. The addition of bivalent alkaline earths stabilizes the tetragonal crystal structure, or in other words, the phase transition to form a distorted orthorhombic lattice is suppressed.

In this way lattice oscillations occur; they have a specific frequency which is important for the Cooper electron pairs.

The atoms, which oscillate rhythmically in their lattice positions, push the duplets. A number of theories, some of which are still controversial, are based on this strong electron-phonon coupling.

So what is the reason for the hectic activity caused by the increase in the transition temperature?

Initially, the increase to 35K was of scientific interest only. However, it served as a motive for further research because of the prospect of increasing the transition temperature to levels higher than 77K (-196 degrees C), the temperature at which oxygen boils. This has been achieved, and a result of vital importance has been obtained.

The use of liquid oxygen as a cooling agent rather than helium, used previously, offers definite financial advantages and, more importantly, also technical advantages. Liquid oxygen has a far greater heating capacity than helium, thus requiring smaller quantities of cooling agent. Also, 80 percent of the earth's atmosphere is made of oxygen, thus making it readily available in almost unlimited quantities throughout the world.

This aspect is difficult to evaluate fully. In 1983 even the computer giant IBM declared that it was disillusioned and had abandoned work on superconductor systems. In particular, the temperature gap between cooled and non-cooled components posed problems for applications engineers which appeared to be economically insoluble.

However, the possibility of producing superconductivity at the temperature of liquid oxygen led to a reappraisal of earlier successes, as it is finally possible, by using "hot" superconductors, to improve the links between the chips which are considerably reduced by heat loss.

Therefore, the obvious next step would be to replace the chips used today, that are based on transistor technology and often function too slowly.

Superconductive Chips With a Higher Clock Rate

A contact which operates with the Josephson effect consists of two 1mm thick superconducting films separated by an even thinner ceramic isolator film. Like a transistor, this can function as an electrical circuit. With the Josephson circuit elements it would be possible to reduce switching times to just 5 pikoseconds. IBM engineers have estimated that superconducting chips could function 10,000 times faster than the present transistor chips.

Another major advantage is represented by the fact that the component has an extremely low power intake and there is a total absence of heat loss. If there is no friction, there is no waste of heat either. Today, computers consist to a large extent of cooling surfaces and units. A computer such as the IBM 3090 has a surface requirement of approximately 8 to 10 sq.m. and a height of 1.8 m. By using superconductors it could be reduced to the size of a refrigerator.

Superconductive coils can also be used in power generators to great advantage. By reducing the size of the generators by one-half or by one-fourth, the efficiency can at the same time be increased by 0.7 percent, from 98.8 percent to 99.5 percent. This increase is especially important in the partial load field, as the level of efficiency varies only slightly with load. Although this is not a massive improvement in absolute terms, it still means that given a 1000 MW generator and a duration of 30 years, 1.75 million MW/hr additional energy can be produced, worth approximately DM210 million.

Many other applications are possible, such as magnetic ore dressing [Erzaufbereitung], sewage treatment, or deoxidizing melting baths [Schmelzbadberuhigung] for producing bigger monocrystals. Superconductor components could lead to considerable improvements in the production of smaller and more efficient electromotors and energy storage in coils. Nuclear spin tomography requires large magnets with strong magnetic fields to prepare for new openings in medical diagnostics.

Ceramics are Still Distant Hi-Tech Applications

Before hi-tech applications can be achieved, the problem of raw material supplies is one aspect that must be solved. Yttrium and lanthanium are present in the lithosphere in quantities of 3.0×10^{-3} and 4.4×10^{-3} respectively. That is approximately 10 times more than copper (3×10^{-4}), 2,000 times more than silver (5.7×10^{-6}) and as much as 10,000 times more than gold (3×10^{-7}). Rare earth elements before cerium (ordinal number 58) up to lutentium (ordinal number 71) make up between 0.01 and 0.02 percent in weight of the earth's crust.

Even the rarest rare earth element, thulium, is 2.7×6^{-5} percent in weight more common than silver.

But the latter elements are very evenly distributed in rock. Deposits or quantitative accumulations of the corresponding minerals are relatively unknown. Up to now there has been little call for these "exotic" elements.

In the past this led to the fact that for example, the entire yttrium world market was dominated by 2 companies: The American Molycorp and the French Rhone Poulenc group. At present, the 500-600 tons of yttrium produced annually are used primarily for the production of color television tubes, lasers, special glass, and other hi-tech products. The current price is around DM1000 per kilogram. Rare earth prices of a few dozen DM per gram are no exception. Gunter Bogner, leader of the Siemens AG research institute says: "We estimate that for example, the raw materials yttrium oxide or

barium carbonate and copper oxide in powder form cost approximately DM10,000 per 100 kilograms."

On the yttrium market, the first signs of a bottleneck in supply are already visible. British research centers have already begun to stockpile this material in order to ensure supplies for the future.

Therefore, it seems questionable, first, whether enough raw material is available, and second, whether the cost benefits of using liquid oxygen cooling are not outweighed by the disproportionately higher cost of the raw materials. The world market for superconductive wires based on original niobium-titanium totals 300-500 tons, or DM100 million at current prices.

Researchers throughout the world are now facing other unsolved technical problems such as the production of flexible wires or the increase of previously unsatisfactory current capacity.

8701
CSO: 3698/M442

CNES 1987 BUDGET ANALYZED

Toulouse LA LETTRE DU CNES in French 1 Jun 87 pp 2-4

[Article under the "Policy and Decisions" rubric: "The CNES 1987 Budget"]

[Text] The year 1986 was marked mainly by the successful launch and operation of SPOT 1, the first French earth observation satellite; the success of the Giotto mission and Europe's start on the development of a space infrastructure, in particular by the start-up of the Mermes preparatory program.

Two major areas form the basis for the actions considered in the CNES [National Center for Space Studies] 1987 budget:

- The first area concerns continued efforts to enable French and European space industry to strengthen its drive and credibility in the operation and marketing of space products and services. Particular attention should be drawn to the Ariane 4 launch rocket, telecommunications satellites and the European PSDE (Payload and Spacecraft Development and Experimentation) program for the preparation of advanced technologies in this area and the SPOT and ARGOS operational systems. Finally, the indispensable development of the associated ground facilities should not be forgotten: the Guyana Space Center and the control, processing and testing systems.

- The second area involves completion of all the preparatory studies. This phase precedes any definitive commitment by the European governments to the new programs, in particular Ariane 5 and the advanced technologies for air-breathing engines, as well as the European autonomous program for manned flight including Hermes, Columbus and the DRS telecommunications relay satellite. In addition, the French Government has just decided to undertake the Topex-Poseidon project in cooperation with the United States. The Locstar project is being examined. These programs are supported by a sustained effort in scientific and technical research which is indispensable to mastery of the technologies required for implementing future programs. Particular attention should be drawn to the preparation of the lengthy flight mission in cooperation with the Soviet Union. Commitment appropriations totaling Fr 6,218.065 million have been provided for all these programs and activities.

The table below gives a breakdown of the institute's 1987 budget, including tax, classified by financial sources.

Table 1. Initial 1987 Budget (inclusive of taxes)

Headings		Budget (in million Fr)
Government subsidies:	- program authorizations (PTT chapter 69.59)	4,376.000
	- base budget (MRT chapter 36.80)	646.170
Subtotal		5,022.170
Internal funding		1,195.895
Total		6,218.065

Note: Since the initial 1986 budget was Fr 6,041.763 million, it can be seen that the initial 1987 budget is 2.95 percent larger than the 1986 budget. When the VAT [value added tax], which CNES pays on the operating subsidies, is deducted, the actual resources available to fund the operations described in the 1987 budget total Fr 5,914.595 million compared to Fr 5,848.239 million in the initial 1986 budget, or a 1.1-percent increase.

The CNES budget (subsidies + internal funding) is divided into four major parts:

- multilateral cooperation

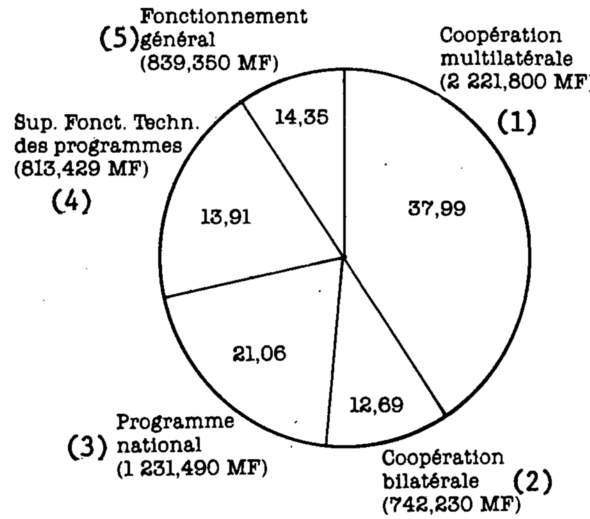
- bilateral cooperation

- national program

- technical operating support for the programs and general operations.

The graphs below show the change in these four items (general operations shown separately) between 1986 and 1987 (in current million Fr).

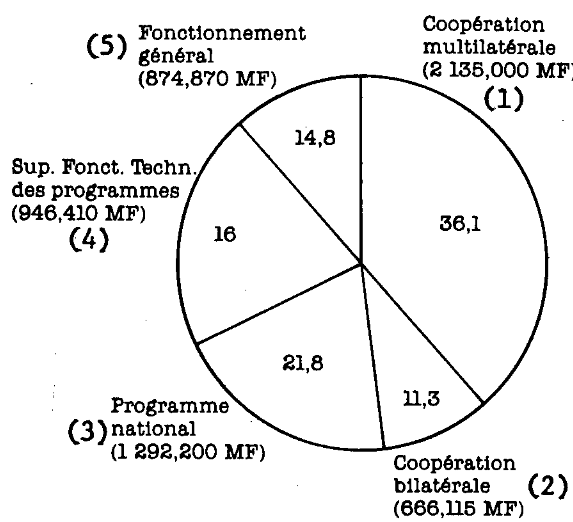
Graph 1. 1986 Budget: Fr 5,848.299 Million



Key:

1. Multilateral cooperation (Fr 2,221.800 million)
2. Bilateral cooperation (Fr 742.230 million)
3. National program (Fr 1,231.490 million)
4. Technical operating support for the programs (Fr 813.429 million)
5. General operations (Fr 839.350 million)

Graph 2. 1987 Budget: Fr 5,914.595 Million



Key:

1. Multilateral cooperation (Fr 2,135.000 million)
2. Bilateral cooperation (Fr 666.115 million)
3. National program (Fr 292.200 million)
4. Technical operating support for the programs (Fr 946.410 million)
5. General operations (Fr 874.870 million)

Multilateral Cooperation

The scientific programs include:

- Satellites in operation, including IUE, or International Ultraviolet Explorer, (ESA, NASA, UK); ISEE, or International Sun Earth Explorer, (NASA); EXOSAT, or European X-Ray Observatory Satellite, (ESA) and Giotto (ESA);

- Ongoing programs, including the space telescope (ESA, NASA), Ulysse, formerly known as the International Solar Polar Mission (ESA), and Hipparcos (ESA);

- New programs, including two new ESA projects for scientific satellites (Soho and Cluster) and future programs including Cassini, Quasat and Lyman.

In the area of telecommunications satellites, there are the ECS [European Communications Satellite] point-to-point telecommunications satellites, the Prosat maritime telecommunications satellites, the inter-orbit IOC, Eureca [European Retrievable Carrier] and DRPP [not further identified] telecommunications satellites, the telecommunications R&D for the Payload and Spacecraft Development and Experimentation (PSDE) program, the ECS second-generation satellites and the Advanced Systems and Technology Program (ASTP).

In the field of earth observation, the ESA programs Meteosat, ERS-1 (Earth Remote Sensing) and EOPP (Earth Observation Preparatory Program) should be mentioned.

With regard to space vehicles, the programs involve the Spacelab space laboratory including the Eureca platform, research in microgravity and the space station.

In the area of launch facilities, France, being an ESA member country and participant in the manufacture of the Ariane launch rockets, is contributing to the operation and renovation of the facilities of the Guyana Space Center. However, the largest expenditures concern the Ariane program, in particular the Ariane PO 5 preparatory program for developing a launch rocket equipped with an HM60 cryotechnical engine (Vulcain) which should be operational by 1995. Also, the preparatory program for the Hermes shuttle is being integrated into the European Columbus space project including the data relay satellite.

Bilateral Cooperation

These credits concern cooperation with NASA and include:

- the Ulysse scientific experiments, space telescope, Galileo, Jupiter 3, Winter UARS (Upper Atmosphere Research Satellite), Lidar (LASE and Leandre projects), Crustal Dynamics, Topex-Poseidon, Medoc II, Erbe, Sage, and TTS;

- the manned-flight program with the MEPHISTO (Equipment for the Study of Interesting Solidification Phenomena on Earth and in Orbit) experiments, As de Coeur [Ace of Hearts] and Esope;

- the earth observation program involving both the exploitation of earth resources using data from U.S. or French satellites or the shuttle, and, in meteorology, the ARGOS program for data collection and ponpointing location;

- the Sarsat-Cospas program for locating, identifying and quickly rescuing ships and aircraft in distress which are equipped with a special, low-cost transmitter.

Another major CNES activity involves cooperation with the Soviet Union in scientific programs such as Gamma, Spectre III, Sursauts Gamma, Interbol, Vega, Sigma, Phobos, Comet and geoscientific experiments. It also includes a program of manned flights, in particular a lengthy manned flight which will take place in 1988.

Cooperation with the European Space Agency focuses mainly on scientific experiments under development (such as Spacelab, ATSR/M, First Pronaos, Hipparcos) or in progress (GOES 2, ISEE and Giotto). It also involves activities in telecommunications (IOC) and manned flights with the Spacelab D2 and Eureca missions scheduled for 1991.

Cooperation with the FRG continues in the area of telecommunications with the TDF-1 direct TV broadcasting satellite program in France and TV-SAT in the FRG. Launches of these two satellites by the Ariane rocket were postponed to 1988 because of Arianespace's new launch schedule.

CNES cooperates with other countries, such as Sweden (Tele X, Viking) and with various European countries (e.g., the VLBI [very long baseline interferometry] experiment). It is participating in the preparation of future missions which will be conducted in cooperation with its usual partners or in a national framework (Cluster, Soho with ESA, Magnolia with the United States and Vesta with the Soviet Union). Finally, CNES cooperates with developing countries in bilateral projects for the preparation of space product exports.

National Program

Scientific experiments mainly involve balloon and geodetic experiments as well as various other biological experiments.

As regards telecommunications, the CNES is providing the team for the Telecom 1 project and is upgrading its line of telecommunications satellites designed for export: It is studying the design of a platform (Spacebus) suited for the market of the 1990's.

The budget for earth observation is mainly allocated to the SPOT program involving the operation of SPOT 1 and the preparation of SPOT 2, which will be ready for launching by mid-1987. To ensure continuity in image supply services and to adapt the satellite to the evolution in competing products and to changing market needs, CNES has proposed to postpone the modifications initially scheduled for SPOT 3 to SPOT 4; SPOT 3 will thus be identical to SPOT 2.

In addition, a drive is planned in 1987 to promote the use of SPOT data and to improve image processing techniques. CNES also is supporting teledetection applications by airborne instruments within the GDTA (Group for the Development of Airspace Teledetection) and is participating in the buildup of SPOT-Image equity capital.

Finally, in association with IFREMER (French Research Institute for Exploitation of the Sea) and DMN (Directorate of National Meteorology), CNES is participating in the establishment of a center dedicated to filing, processing and delayed distributing of the data from the ERS-1 satellite.

Work on the development of balloons is also planned because this type of space vehicle constitutes a unique observation instrument and is a necessary complement to the satellite observation programs for scientific research.

Achievement of the 1987 goals of the 1986-1988 R&D plan involves the continuation of traditional objectives (radio communications, earth observation and science) and consideration of changes needed to stay abreast of techniques linked to new applications of orbital infrastructure.

Following the budget of the multiyear plan, funding of the major R&D topics in 1987 is divided as follows: 21 percent for radio communications, 22 percent for earth observation, 14 percent for orbital infrastructure, 18 percent for launch facilities and 25 percent for science and multipurpose basic techniques.

Moreover, these credits take into account the 1987 portion of the program linking CNES to Novespace Corp. (founded on 8 July 1986), whose job it is to apply and transfer space technologies to non-space industries.

Finally, general measures designed principally to improve product quality and the management of space programs are scheduled for 1987.

Technical Support of Programs and General Operation

Funding of this item increased from Fr 1,652.799 million to Fr 1,821.280 million. General operation of the CNES departments (personnel and operating costs, external relations, travel costs) amounts to Fr 874.870 million.

The remaining Fr 946.410 million are allocated as follows:

Table 2. Budget for Technical Support of Programs

Heading	Budget Allocation (in million Fr)
Internal and external laboratories	30.570
Technical operating and launch facilities	775.340
Infrastructure and equipment work	140.500
Total	946.410

The authorized CNES personnel totaled 2,169 in 1986 subdivided as follows:

- Head office (Paris)	192
- Evry Space Center	232
- Toulouse and Air-sur-Adour Space Center	1,421
- Guyana Space Center	324

In 1987, 58 new jobs will be created, bringing the total number of employees to 2,227. In addition, the Guyana Space Center employs some 460 people assigned by CNES contractors providing technical support.

25053/12859
CSO: 3698/A294

MID-SIZE FIRMS FEAR LOSS OF FRG AEROSPACE SUBSIDIES

Duesseldorf VDI-NACHRICHTEN in German No 34, 21 Aug 87 p 1

[Article by Wolfgang Mock: "In the Long Run Mid-Size Industries Will Remain Behind;" first paragraph is VDI-NACHRICHTEN introduction]

[Text] VDI-NACHRICHTEN, Duesseldorf, 21 August 1987--In the past 25 years, FRG involvement in national and international space research has cost the FRG taxpayer DM15 billion--and lately an average of DM1 billion per year. The present government plans to double the yearly space allocation, bringing it to DM2 billion. Protests against this decision come in particular from medium-sized industries. These firms fear not only that the new space subsidies will overlook them entirely but also that the subsidies allocated to date for mid-size research will be reduced to almost nothing by 1988.

Until just over a year ago research minister Heinz Riesenhuber was still treating small and medium-sized firms as the "spoilt children" in government research subsidies and so far, little has changed as far as political rhetoric is concerned. However, the fact is that the credit program for personnel expenses of the Ministry of Trade & Industry will be terminated ahead of schedule, as will the Ministry of Research's subsidy program for personnel increases. The Ministry of Research's model project "Establishment of technology-oriented firms" will be abandoned along with the program for research cooperation between industry and science. Even tax advantages will be suppressed as of 1989.

The spoilt children have lost their exclusive position, and as consolation they are now faced with the effects of the coming tax reform and the EC subsidy plans.

Medium-sized industries have lost their priveleged position to the new favorite, space research. Many such firms fear that their involvement in research projects will be limited to acting merely as subcontractors to major industries. In fact, Josef Gruenbeck, FDP [Free Democratic Party] spokesman for the interests of medium-sized industry, believes the "Aerospace Monster" cannot be financed. Juergen Metzger, director of the association of managers of medium-sized companies, to which Gruenbeck also belongs, is more positive about the involvement in space research, but is also worried by the fact that "medium-sized firms will have no say in this field, because the lobby of big industry is very strong." Similar fears are expressed by the association of

industrial research institutes.

Helmut F. Bachmann, member of the management board of the Federal Union for Medium-sized Industry, also talks of "one-way" direction and procedures toward a "monocultural research and industry landscape." "In large scientific projects like this one, innovative participation by medium-sized firms could only take place in exceptional cases." Should such a long term research policy be adopted, Bachmann fears that know-how will be concentrated in big business. Personal and intellectual shortcomings in mid-sized industry will gradually lead to its disappearance, and consequently a dramatic change in our industrial landscape.

The National Union of German Industry (BDI)--hardly a spokesman for medium-sized industry--expressed similar criticisms when it demanded the incorporation of space research in a global research framework. Bearing in mind the plan to end research subsidies to medium-sized firms, research and political BDI spokesman, Carsten Kreklau deplored "the fact that the research minister has large amounts of national funds available to spend--but not for an established long-term national program--rather, it is primarily for the ESA program."

According to Kreklau, such a research subsidy--amounting merely to catching up with a train--not only overlooks the national interests of FRG industry, but also undermines the role of the German industrial community in determining future research priorities. He also regrets that in the present research policy, "medium-sized industries have essentially not been taken into account."

8613
CSO: 3698/M441

HEINEMANN, USSR'S ORDSHONIKIDSE ESTABLISH JOINT VENTURE

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 459/456, 20 Jul 87 p 17

[Excerpt] The Heinemann Mechanical Construction company of St. Georgen/Schwarzwald will be the first German enterprise to establish a joint venture with a Soviet firm. The agreement between Heinemann (200 employees) and Ordshonikidse (10,000 employees) provides for [the creation of] a joint parent company called "Homatech," 55 percent of which will be controlled by the Soviet company. The firm is expected to manufacture earth movers in the Soviet Union, which will be equipped with special parts from the FRG.

As part of the economic reforms introduced by Gorbachev, the USSR has begun to follow the example of most socialist countries by allowing foreign capital investments. The conditions for capital investments from industrial and developing countries were established in decrees issued by the Presidium of the Supreme Soviet and by the Council of Ministers on 13 January 1987.

The regulations provide for the establishment of self-sufficient legal organizations with foreign capital participation which must operate on the basis of independent financing, economic accounting principles, autonomous economy [Eingenwirtschaftlichkeit], and self-financing. The investment conditions granted to foreign partners are outlined more precisely in the introduction to these regulations printed in German. A German translation of the regulations governing foreign trade institutions operating according to the system of economic accounting principles, has also been provided along with comments.

8700
CSO: 3698/M396

FIAT OF ITALY, LUCAS OF UK FORM JOINT AUTO PARTS VENTURE

36980025 Paris L'USINE NOUVELLE in French 8 Oct 87 p 29

[Article by Georges Le Gall; first paragraph is L'USINE NOUVELLE introduction]

[Text] The new entity formed by Magneti Marelli, its majority shareholder, and the British firm Lucas will cover 25 percent of the European market for alternators and starters.

How deeply will Fiat penetrate the auto parts sector? The Italian group has signed this new agreement with the British firm Lucas just one year after having negotiated with Matra for a 65-percent controlling stake in Jaeger and Solex. In stride, and under the leadership of the Magneti Marelli holding group, Fiat had previously reorganized its parts activities with a new boss, Alessandro Barberis, who has made no secret of his view that this new structure should enable Fiat to become the supplier of all the automobile manufacturers--an ambition that is asserting itself.

The agreement with Lucas covers alternators and starters. A British company, Magneti Marelli Electrical, 70-percent owned by Magneti Marelli, is to be formed. It will take over the activities of the Birmingham plant, which employs 1,600 persons, and will be a subsidiary of the Italian firm Industrie Magneti Marelli, which specializes in electrical parts. In its niche, the new firm will represent an annual revenue of Fr 1.5 billion and 25 percent of the European market. Fiat will double its volume in this domain, since until now Magneti Marelli's share has been 13 percent and Lucas's 12 percent.

The new entity will thus rank third in European market share, behind Bosch's 40 percent and Valeo's 30 percent (in 1984, Lucas ceded to Valeo its share of Ducellier). Its "electric motor parts" branch, which produces mainly alternators and starters, had revenues last year totaling Fr 2.9 billion.

As of last June, Magneti Marelli and Lucas had already signed a preliminary agreement. It will be finalized juridically and financially in 1988. It covers lighting, a domain in which Fiat lags: Its SIEM subsidiary will have 1987 revenues of only around Fr 380 million (with 750 employees). But Magneti Marelli will be taking over control of Lucas's "lighting" division in

Great Britain, and of the Carello company in Italy, in which Lucas is the majority shareholder. The new lineup will have annual revenues totaling Fr 1.6 billion, with 3,750 employees. It will represent some 25 percent of the European market, and will rank behind Valeo, the market leader with 30 percent (whose "lighting" branch had 1986 revenues of Fr 2.1 billion), and ahead of the German firms Hella and Bosch.

With the contributions made by Jaeger and Solex, Magneti Marelli already occupied choice positions in the European market: 60 percent for carburetors, 50 percent for dash boards, and 25 percent for electronic ignition systems. And now it is well up among the big ones in alternators and starters, and lighting. For its first year, the Magneti Marelli holding company will represent a 1987 annual revenue of around Fr 12 billion--well behind Bosch's Fr 73 billion in 1986, Fr 39 billion of which were in its automobile sector, but up with Lucas's Fr 16 billion (Fr 12 billion in its automobile sector) and Valeo's Fr 12.2 billion.

Backed by Fiat, Magneti Marelli can still grow. This year, its investments will total Fr 1.5 billion, and its research budget Fr 0.6 billion.

9399

PEUGEOT USES NEW HIGH-SPEED, 7-AXIS ROBOTS TO PAINT 48 CARS/HOUR

36980025 Paris L'USINE NOUVELLE in French 8 Oct 87 p 63

[Article by Michel Defaux]

[Text] Robotics has made its debut in the application of interior lacquers. At Peugeot's Mulhouse plant, Cabin 313 has been used to test new approaches on a reduced scale but in industrial configurations. It is a pilot installation whose lessons will be applied shortly at Sochaux and Rennes.

The complex problem of robotizing the painting of car interiors was first attacked in 1985. Two AKR 7-axis robots (6-axis robots moving along an axis at floor level) were installed at that time to paint the engine compartment, the underside of the hood, and the underside and topside of the rear trunk lid. One year later, with two additional robots of the same type, accompanied by two door-opening and -closing robots, they were painting the frames and interiors of forward and rear doors. A total investment of Fr 23 million (including Fr 11 million for the robots) in the quest for improved quality, higher productivity, and improved working conditions.

The technical challenge was daunting: Robots had to be installed in a cramped cabin (40 m long by 5 m wide) without modifying its architecture, and without introducing any stops in the movement of the painting-and-drying line, which had to attain an output rate of 48 vehicles per hour (in lieu of the previous 38 per hour). These particularly severe constraints called for a painting--on-the-move operation: Since the conveyor cannot be stopped, the robots must lock into step with it as each new vehicle arrives, before going into their "ballet." "We are the only ones working on a mass production line basis with 7-axis robots inside a cabin," says Jean-Claude Muth, head of the Mulhouse production center's painting unit. "Most automobile manufacturers paint the bodies at rest, which requires a lot of floor space. In our case, this method would have reduced our output by half."

The thorniest problem was that of organizing the trajectories of the robots in such a small space. Programming gimmicks had to be devised to compose and synchronize all the required movements. The result is altogether spectacular. Immediately following entry of the identified vehicle into the cabin, the door-opening robots place their grippers in a forked configuration

Evolution of Cabin 313

Item	Manual Line (1977-1978)	Robotized Line (1987)
Production	38 vehicles/hour (104)	48 vehicles/hour (205)
Personnel	15 persons X 2 shifts, or 30 persons a day	5 persons X 2 shifts, or 10 persons a day
Paint consumption	4-door sedan Model 104 0.130 liters/sq. m.	4-door sedan Model 205 0.115 liters/sq. m.
Retouching	15 percent for lacquer alone	6 percent for lacquer alone
Average thickness	25 to 55 microns - 2 coats	40 to 55 microns - 1 coat

against the door, calculate their position, and reposition themselves to introduce their grippers into the rabbet of the door. As soon as the doors are opened, the painting robots take over, contorting to meet the requirements of the job. Actually, the edge of the door of a 205, in its open position, is only a few centimeters distant from the wall of the cabin. The 6 robots (4 for painting and 2 for the opening of the doors) maneuver over a distance of 14 meters. To attain the requisite rate of output, the operation must be completed in 3 minutes, which requires spraying at a speed of 0.6 to 0.8 meters/second. And when a 5-door vehicle arrives, the operation comes close to resembling a panic. Thus, the spraying time needed for the door-painting operations matches to the very second the vehicle's transit time through the cabin. The rear-doors-opening robot must move out of the way very fast, while still performing its operation, to avoid bumping up against the downstream robot. Furthermore, these movements must be accompanied by constant readjustment of the flow of the paint to avoid runs and pits in the finished paint job.

Programming required the use of a syntaxer, which reproduces the movements of the painter. However, this solution was found to be unsuitable for certain interior portions, such as the posts, making it necessary to revert to analytic, that is, point-by-point, programming. The result is still not perfect, in that, certain parts of the bodies (10 to 20 percent of total areas involved) are not easily reached by the spray gun. Therefore, two painters do the necessary retouching (rear edges of the hinges, for example) after the vehicle leaves the cabin. Another advantage of robotics is that these retouches are always in the same spot and of the same size and thickness, which was far from being the case before, when the spray painting was done manually.

The ideal solution would consist of programming off-line based on the description of the volume by CAD workstations. "We are working on this approach on an experimental basis. The programming of the painting robots by CAD will be done on a production basis within 2 years."

The installation, which has been in operation since the start of the year, has experienced an outage-time rate of around 10 percent. Essentially, outages are owing to the difficult conditions under which the robots are required to work. The solvents attack their protective coatings, which must be replaced, and foul the floor-level seventh axis. Hence the interest being shown in the new robots being put on the market, with a seventh axis mounted laterally along a wall. These will probably be the choice for Sochaux.

9399

FRG PROSPECTS IN BIOTECHNOLOGY R&D EXAMINED

Augsburg INDUSTRIE UND HANDELSKAMMER in German No 5, 18 Nov 86 pp 34-41

[Article by Dr Norbert Rau, chairman of the board, RAUCON Bioengineering Industry, Dielheim, FRG: "Biotechnology in the FRG--Status and Prospects"]

[Excerpts] Market Boom or Technological Incentives?

On the one hand, biotechnology is an advanced technology in terms of conventional fermentation processes. However, what is known as modern biotechnology--the recently created scientific methods of genetic engineering, cell fusion technology, and enzyme technology--is simultaneously a new and innovative technology. This is one reason for the considerable confusion when it comes to assessing markets and commercial prospects. In the "mature" fermentation technology, we note that because of the low price of raw materials many fermentation processes were replaced by chemical processes several decades ago, or remain competitive only with considerable effort. Other processes exist only thanks to legislation; for example, the production of alcohol for use in foodstuffs. Others remain competitive because they produce substances that can only be produced biotechnologically. The competitive situation for potential alternative methods is shown in Figure 1.

Biotechnological Research

A survey we have conducted and not yet completed (as of January 1987) shows that at least 600 to 700 German institutes are concerned with aspects of basic or applied research of immediate importance for biological questions. At present, more than 300 bioscientific, chemical, and medical institutes use genetic engineering methods as a research instrument. Another 60 to 80 institutes plan to introduce genetic engineering work groups in the next few years.

Priorities for biotechnology are being set in many universities mostly as an integration of several institutes. Priority efforts exist in the areas of Hannover-Braunschweig-Goettingen, Stuttgart, Hamburg, Munich, and other places. In addition, there are the formal biotechnology institutes such as the Society for Biotechnological Research mbH [GBF] in Braunschweig, which is considered the largest institution of its kind in the world with over 400 employees. At the nuclear research installation in Juelich two biotechnology institutes conduct important environmental and enzyme technology research. In

Cologne, the Max Planck Institute for Breeding Research and the University Institute for Genetics have gained worldwide scientific recognition. The Fraunhofer Institute for Surface and Bioprocessing Technology in Stuttgart conducts R&D within the framework of a priority effort for bioprocessing technology with the participation of several institutes. Another Fraunhofer institute, the Institute for Food Technology and Packing, also works on biotechnological questions and will expand this area of research in the future. In Heidelberg, a European institution, the European Molecular Biology Laboratory (EMBL), is concerned exclusively with molecular-biology, genetic engineering, protein-chemistry, and other basic research issues. In addition there is the Center for Molecular Biology in Heidelberg, which is complemented within a federal framework by the genetic center in Munich and the newest institute, the Institute for Genetic Engineering Research GmbH in Berlin.

The new institutes and the formation of priority efforts in biotechnology indicate the value of biotechnological research in the FRG, both in basic and in applied research. This is also shown by the growing biotechnology research budget of the Federal minister of research and technology. In 1986, DM130 million was allocated for biotechnological research. A considerable amount, but small in comparison with the DM700 million reportedly invested in biotechnological research by German industry, or in comparison with the $1.1/1.0 billion the U.S. Government is investing or has invested in biotechnological research in 1987/1986.

Companies like Degussa already have vast experience in the synthesis of amino acids. The use of immobilized biocatalyzers is interesting. Production statistics are not available, but a growing interest in the production of amino acids by fermentation can be noted.

In comparison to the Netherlands and Denmark, the enzyme-producing industry is not as well developed in the FRG. This is especially true for 25 to 30 artificial enzymes which are produced at a rate of 7,000 to 10,000 metric tons per year by Boehringer Ingelheim, Bayer, Roehm, Merck, Lohmann, and others. A strong position is held by diagnostic enzymes and laboratory enzymes which are produced by, among others, Boehringer Mannheim, and are actually already part of "modern" biotechnology. The growing domestic market and growing imports signal a growing interest in enzyme technology. At the present state of the art, the growth should be at least 10 percent. For example, if further technological advances in enzyme technology are achieved in the area of immobilization or stabilization of enzymes, this growth rate would rise considerably.

It is not known how much alcohol is produced by fermentation. No separate statistics are available on this subject. In the FRG, about 300,000 metric tons of alcohol are produced per year, half by fermentation, the other half synthetically. Besides the already mentioned fermentation products, a number of other substances are produced such as acyloine, acetoine, sorbose,

dihydroxyacetone, itaconic acid, nucleic acid, dextran, and more. Finally, there is the area of modern biotechnology, which uses genetic engineering and other modern biotechnological methods. There are about a dozen established, mostly chemical-pharmaceutical companies which use these methods for the manufacture of a variety of products such as alpha-interferon, fibrous--plasminogene activators, insulin and other products. In addition, there are approximately 25 newly founded bioengineering companies, no more than 1 to 5 years old, and another 30 foundations in the process of being approved. These young, promising companies work in all areas of modern bioengineering--from preparations and products for medical diagnostics and therapy; through special laboratory reagents, monoclonal antibodies, biotechnical production of seeds, breeding of micro-organisms for the degradation of problematic substances, development of new equipment for laboratory and production, development of advanced measuring and control technology, including biosensors; and up to the production of software for the control of biotechnical processes. If these companies, which aim at advanced scientific and technical objectives, are successful, they will represent an inestimable reserve for the technological ranking of the industry in the FRG.

One should not forget the quantitatively most important biotechnical application, biological environmental technology, starting from waste water purification, through waste air cleaning, composting of garbage, up to sanitation of contaminated soils. Long established processes, the influence of modern processing technology, and new biotechnological trends play their role. In this area exists a colorful mix of companies, from very small companies to giant concerns.

It is difficult to draw a line between companies that are part of biotechnical firms and those that are not. In reality there are overlaps between conventional biotechnology and modern methods when it comes to the application itself.

This is even more pronounced in the supply industry. Many types of equipment can be used both for biotechnical processes and others.

In table 1 we have listed and evaluated 221 companies in the FRG (there are actually more than 300) which directly deal with modern biotechnical processes, either as a user of these processes in production, or as a supplier or service company. The table also classifies the product area of these companies. More production areas per company could be listed. Without claiming precision, the main efforts become clearer. For example, companies with biotechnological products and processes are mostly active in human medicine (therapeutics, vaccines), diagnostics, the chemical industry, and biosynthetic processes, with the latter categories overlapping. Companies manufacturing installations, equipment, and consumable materials conduct their main efforts in analytical processing, biosynthetic processes, and equipment for biotechnological research laboratories. In the meantime, different areas

of main efforts may be found in comparable fields of activity between biotechnical industries and suppliers, as shown in Figure 3. No particular emphasis can be distinguished in service companies.

Prospects

Even without a detailed description, the number of research institutions either concerned with important aspects of basic research for biotechnology or directly involved with biotechnological or genetic engineering methods shows that on the scientific side there is a rich basis which can face any international comparison. The present research subsidy will insure that this basis is reinforced and that possible weak points are improved. On the industrial side, a very strong interest is shown at present by non-biotechnological firms. After the usual definition phase, this interest will yield to concrete activities. The prerequisites exist also from the industrial side, as was shown above.

How then can the technology push be transformed more efficiently into application? Part of this can be achieved by supportive framework conditions for biotechnology such as strong applied biotechnological research and an improved interface between research institutions and industry in order to transfer innovative ideas better and faster from one side to the other. This means that academics and researchers should acquire more commercial understanding, and the entrepreneur more scientific interest than is the case at present (a positive trend must however be noted).

Some misunderstandings must also be cleared up. There is the widespread perception that U.S. genetic companies only work on the basis of risk funding, which does not exist to this extent in our country. This is incorrect. It is true that financing and financing modes play an important role, but more important for the companies are tax conditions, and especially the entrepreneural spirit of American founders of companies and financiers which is completely different from our country. Another misconception is the widespread assumption that biotechnology is only a field for large companies like Hoechst, Bayer, BASF, and so on. It is true that many developments, particularly in the pharmaceutical area, require high investments. However, many examples show that small companies with average financial standing but exceptional ideas perform astonishingly well. The innovative power per employee in small companies is generally many times that of a large company. Another widespread assumption is that "the train has already left the station." The United States certainly has a technological advantage. On the other hand, trying to diminish the advantage in areas that are considered the domain of American companies does not make sense. Instead, attempts should be made to find new applications from among the mass of possibilities. Also in the area of modern biotechnological research there are first, second, and third generation developments. It is important to join the development of next generation methods.

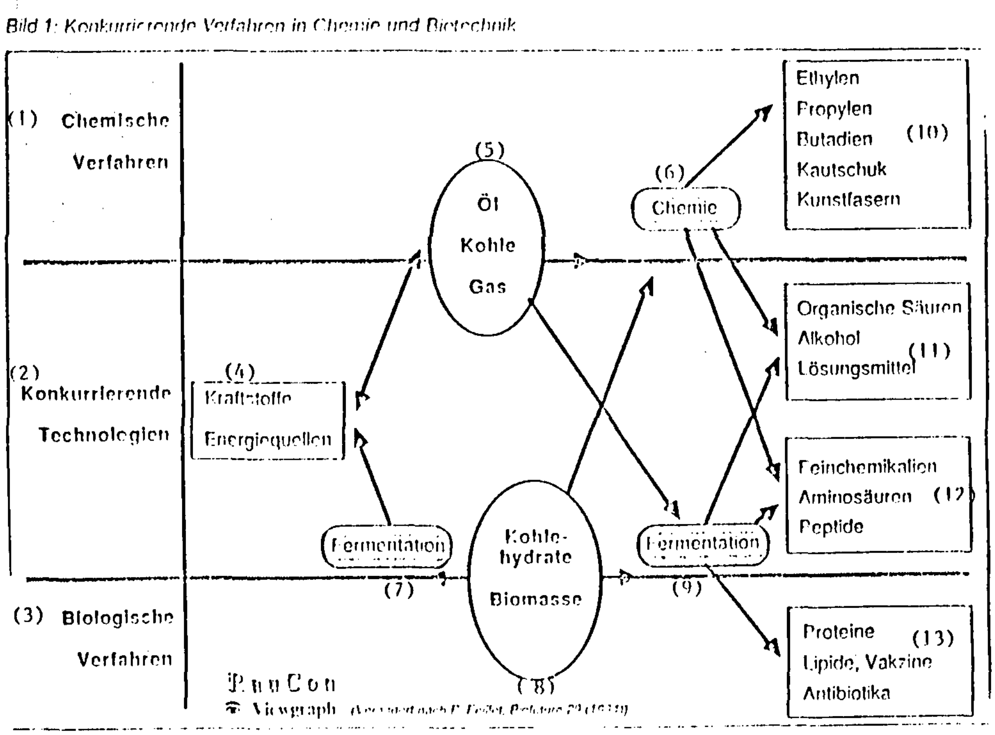
There are very positive developments which will come to bear in the near future. Apart from the already mentioned growing interest of industry, it is predominantly the stronger trend of university institutes toward biotechnological research that can be utilized in industry. Hostility toward industry, still very evident in many places a few years ago, is decreasing. At the same time, research subsidies for biotechnology are increasing and the work of newly created "genetic centers" is showing results. The creation of companies has started to interest scientists, following the important pioneering role of a few individuals. Finally, German biologists overseas have become more interested in working in the FRG after moving to North America years ago in pursuit of realizing their applications-oriented, practical scientific work. Discussions on a social level have become more factual. The fear of many small Frankensteins and the excitement over the possibility of Einstein clones has almost disappeared. The possibilities and risks of genetic engineering are now being discussed and evaluated more realistically, especially by those who were negative in the first place, and also by those who were merely enthusiastic. (There are still exceptions, but these belong to the area of opinion manipulation, which is certainly no less dangerous than gene manipulation). Last, but not least, this is the result of more and more qualified press coverage.

There are some obstacles, but generally more that affect innovations rather than the application of biotechnological developments. Part of this is tax legislation, which prevents companies from accumulating capital resources and makes intensive capital investments a risk. The speed of innovation in German companies as compared to competition in the United States or Japan is generally deplored. However, the underlying cause may be seen in the tax legislation mentioned above because it is evident that international competition in high technology is becoming more and more a contest of tax and subsidy systems. Perhaps the somewhat rigid thinking of entrepreneurs in the field of biotechnology adds to this. This problem is connected to the structure of our industry with its machine engineering model, which is rather incompatible with biological patterns. The fact that the chemical industry has entered biotechnology only very slowly is certainly due to the excellent sales of chemical products in recent years. In such cases the openness to innovation is always minimal. Another reason could be the low percentage of biologists (approximately 3 to 4 percent) among researchers in the pharmaceutical-chemical industry, which lags behind other countries.

Perhaps the largest obstacle is the fascination with numbers. In part we are dealing with completely new markets. When entrepreneurs make decisions only when market data are available, it means that other entrepreneurs are necessarily ahead: precisely those who created the market data in the first place by producing sales. Those who want to skim the cream--the market bonus--off the new markets cannot merely stare at figures, but must base their decisions on the qualitative factors of the market, the general changes, and the technological possibilities. The International Management Institute in

Geneva stated last year: "Neither a fourth foreign language nor ADP will decide the quality of the next generation of managers, but rather their capacity to make decisions under uncertain conditions. Visionaries of the Lee Iacocca type are required to know how to connect analytical thinking with imagination and creativity." This is precisely what is required in the present situation to transform technological incentives into a market boom.

Figure 1: Concurrent Processes in Chemistry and Biotechnology



Key:
1. chemical processes
2. competing technologies
3. biological processes
4. fuels, energy sources
5. oil, coal, gas
6. chemistry
7. fermentation
8. hydrocarbons, biomasses
9. fermentation
10. ethylene, propylene, butadene, caoutchuc, artificial fibers
11. organic acids, alcohol, solvents
12. fine chemicals, amino acids, peptides
13. proteins, lipides, vaccines, antibiotics

Table 1: Activities of 221 Companies in Biotechnology

Tabelle 1: Aktivitäten von 221 Firmen in der Biotechnik 1)

Von 221 Firmen in der Bundesrepublik Deutschland bieten an...2)

(4) ...biotechnische Produkte und Verfahren für die Anwendungsbereiche:		(4) ...Anlagen, Geräte und Verbrauchsmaterialien für die Anwendungsbereiche:		(6) ...Dienstleistungen für die Anwendungsbereiche:	
(3) Bioelektronik	1	(5) Analysen	54	(7) Analysen, Tests, Untersuchung	7
Biosyntheseprozesse	16	Biosyntheseprozesse	39	Beratung, Patente, Lizenzen u.a.	6
Chemische Industrie	20	Biotechnologische Labors	20	Biotechn. Information (Datenbankservice)	1
Diagnostikaherstellung	22	Computersteuerung und -systeme	11	DNA/Peptidsynthese	3
Downstream Processing	2	Diagnostikaherstellung	7	Downstream-Processing	1
Energiewirtschaft	3	DNA/Peptidsynthese	3	Forschung & Entwicklung halbstaatlich	2
Forschung	12	Downstream-Processing	46	Forschung & Entwicklung privat (Auftragsentwicklung)	5
Futtermittelindustrie	5	Medizin	1	Finanzierung	1
Gentechnik, Molekularbiologie	5	Messung und Regelung	13	Ingenieurleistungen	5
Humanmedizin	49	Methanisierung	3	Lohnproduktion, Synthese	2
Nahrungs- und Getränkeherstellung	11	Nahrungs- und Getränkeherstellung	1	Prozeßdesign, Scale-up, Auslegung	3
Ölförderung	1	Reinraumtechnik	8	Screening und Stammverbesserung	3
Pflanzliche Landwirtschaft	12	Sequenzierung	6	Sequenzierung	4
Textilindustrie	1	Sicherheitstechnik	1	Software-Entwicklung und -Verkauf	7
Umwelttechnik	16	Trinkwasserbehandlung	2	Weltraumbiologie	1
Veterinärmedizin	3	Umwelttechnik	15	Zellsammlung	1
Weltraumbiologie	2	Weltraumbiologie	1		
		Zellfusion	3		

Key:

1. 221 companies in the FRG industry
2. ...biotechnical products and processes for the application areas:
3. bioelectronics 1

bioelectronics	1
biosynthezising processes	16
chemical industry	20
production of diagnostic agents	22
downstream processing	2
energy industry and trade	3
research	12
forage industry	5
gene technology, molecular biology	5
human medicine	49
food and beverage production	11
oil drilling	1
agricultural plants	12
textile industry	1
environmental technology	16
veterinary medicine	3
space biology	2

4. ...installations, equipment and consumable materials for the application areas:

5.

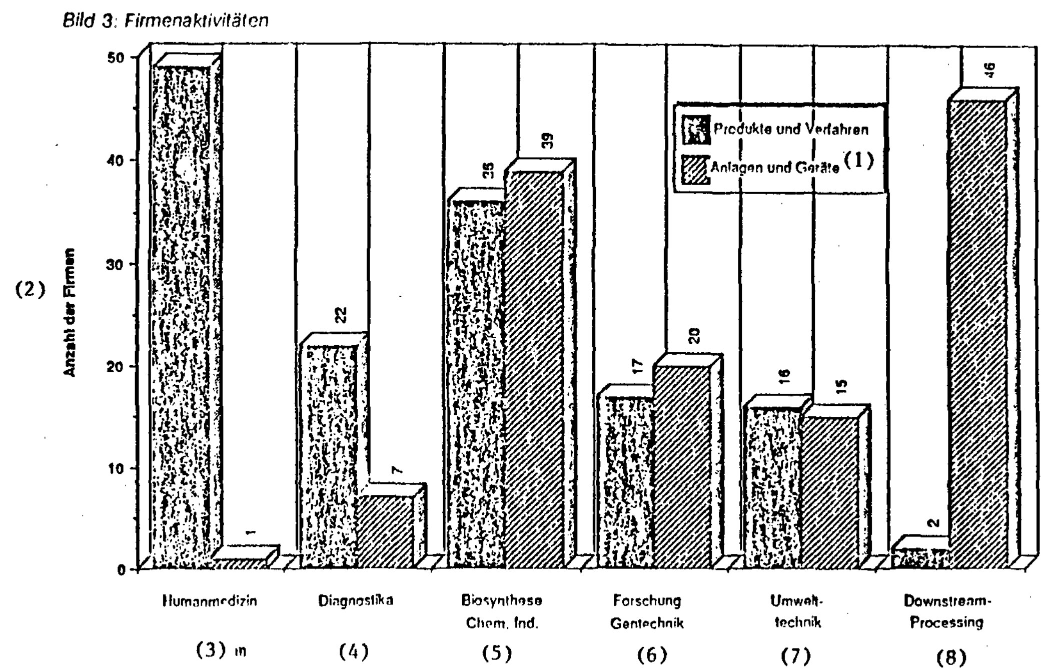
analysis	54
bio synthezising processes	39
biotechnological labs	20
computer control and systems	11
production of dignostic agents	7
DNA/peptide synthesis	3
downstream processing	46
medicine	1
measuring and controlling	13
methane utilization	3
food and beverage production	1
clean room technology	8
sequencing	6
safety technology	1
drinking water processing	2
environmental technology	15
space biology	1
cell fusion	3

6. ...services for the application areas:

7.

analyses, tests, investigations	7
consulting, patents, licenses and so on	6
biotechnology information (databank services)	1
DNA/peptide synthesis	3
downstream processing	1
R&D, semigovernmental	2
R&D, private (contracted R&D)	5
financing	1
engineering services	5
contracted production, synthesis	2
process development; scale-up, interpretation	3
screening and strain improvement	3
sequencing	4
software development and sale	7
space biology	1
cell collection	1

Figure 3: Company Activities



Key:

1. products and processes
   installations and equipment
2. number of companies
3. human medicine
4. diagnostic agents
5. biosynthesis, chemical industry
6. research, gene technology
7. environmental technology
8. downstream processing

8613
CSO: 3698/M415

BRIEFS

BAYER RESEARCH PRIORITIES EXAMINED--In 1986 the Bayer Group invested DM2.074 trillion worldwide in research, 1.176 trillion of which was invested by Bayer AG. According to an analysis of the sales range structure, 40 percent of sales come from products developed over the last 15 years as a result of the firm's own research. Bayer employs approximately 6,272 people in pure and applied research and development (worldwide, Bayer has 12,662 employees). As can be seen from the brochure published by Bayer--(Bayer names, figures, data), the most important areas of Bayer research, comparing 1980 against 1986, are the following:

	1980	1986
Pharmaceuticals, plant protection	36 percent	50 percent
Information technology	21 percent	19 percent
Chemicals	21 percent	17 percent
Industrial and special chemicals, consumer goods	22 percent	14 percent
	DM1.241 billion	DM2.074 billion

In addition, central research is carried out on products and processes of the future irrespective of the sphere of activity; for example, in the fields of solar energy, tertiary petrolium extraction, and microelectronics, as well as in biotechnology and genetics. The Kekule library, with 584,000 volumes, 57,000 dissertations, and 7,000 periodicals, is the largest private chemical library in Europe. [Text] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 463, 14 Sep 87 p 10]

8701
CSO: 3698/M033

CNRS ACHIEVEMENTS IN COMPUTERS, CIM, AI OVERVIEWED

Paris ZERO UN INFORMATIQUE in French 15 Jun 87 p 12

[Article by Jean-Louis Cousin: "Research-Industry Relationships: SPI Looking for Companies..."; first paragraph is ZERO UN INFORMATIQUE introduction; ellipses as in original text]

[Text] Mobile robots used by the RATP [Paris Public Transportation Authority] for cleanup, the automated guidance of light automated vehicles (VAL) in Lille, the invention of Prolog, and many other developments were all achievements of the Engineering Physical Sciences Department (SPI) of the CNRS [National Center for Scientific Research]. Its present director, Jean-Claude Charpentier, highlights a little more than 10 years of activity.

Jean-Claude Charpentier, scientific director of the CNRS's SPI asks: "Do you think people realize that it was researchers of this department who contributed specifically, in a very active and crucial way, to the development of third-generation stand-alone mobile robots (used for industrial cleaning at the RATP), the automatic pilot system for VAL in Lille...or that the Prolog language was invented in an SPI laboratory?"

His recent appraisal of some 10 years of SPI activity (representing about 8 percent of CNRS) allowed him to reminisce, and to emphasize objectives reached and those being pursued in one discipline or another.

SPI's activities taken together cover five main areas, within which 23 S&T objectives have been defined. These are usually managed by a committee made up of representatives from universities and manufacturers. The areas which are of interest to us here are basically in the fields of robotics and automation, AI, communication and parallel architectures networks for programming and microelectronics.

So, first in the area of automation, as we know, the ARA (Advanced Automation and Robotics) program was developed between 1980 and 1985 along with nine primary structures or groups and in association with some 20 manufacturers. The particular objective of this program was to solve problems related to automating the movement of goods and to the creation, assembly and stocking of various industrial products.

At the conclusion of this program several short- (3 years) or longer-term (around 6 years) objectives were adopted. Jean-Claude Charpentier and SPI managers discuss two in particular: "First is everything related to integrated manufacturing automation using workstations and control stations in real time, flexible workshops, advanced continuous process automation and an increase in flexibility, speed, and reliability of manufacturing robots.

"Next, in the area of third-generation robotics, we are planning new developments in the area of 'intelligent' manufacturing systems: clearly with the objective of better manufacturing control, but also looking at the whole process to best integrate product design and description phases."

The Appearance of AI in Industry Is a Major Event of the 1980's

As far as AI is concerned, SPI specialists emphasize "that it is the beginning of a larger movement towards 'friendlier' data processing, which will most likely lead to even more fundamental technological change than we have seen in data processing during the last few years.

"These promising factors should not lead us to forget that AI methods are still in their infancy today. Though it is comforting to note that they already have numerous applications, there are also major limitations: Inference engines are still frequently too simplistic and limited to certain types of reasoning; it is still difficult to build really large databases; expert system validation methods are practically nonexistent. In short, research is an absolute necessity if we want AI to meet user expectations.

In July 1985, the "Artificial Intelligence" GRECO (Coordinated Research Group) was created in combination with the Ministry of Research and the combined programs of the electronics sector. Its general objective is to "structure and reinforce French AI research potential and to become a scientific and technological point of reference within that field. First, it will encourage the creation of a coordinated research policy among the teams involved; and second, it will create a reference and information focus for all users on the state of the art, identification of capabilities, perspectives, etc."

The Artificial Ingelligence GRECO links some 17 public research teams, consisting of approximately 250 employees in all, located in the Chambery, Grenoble, Lannion, Marseille, Nancy, Paris, Rennes and Toulouse areas. The group is expected to add about two or three additional teams per year. Manufacturers can work with the GRECO via a so-called affiliation plan.

As far as parallel architectures are concerned, SPI has reached the point where "we are studying both semantics and the application of parallel algorithms to integrated circuits with a very large-scale integration (VLSI)." And to emphasize: "There is not a single large user of data processing who does not expect research in this area to reach previously unheard of performance gains with better quality complex systems, made up of reasonably-sized components, tested separately and distributed over relatively autonomous equipment."

The C3 (Cooperation, Competition and Communication) program was launched to organize and encourage this sort of research. Two research areas were also created in the field of parallel architecture and that of networks and distributed systems.

The development of these architectures or systems leads to problems which can only be solved by inventing new algorithms. So three additional areas were created within C3: "distributed and parallel algorithm," "language" and "semantics and verification."

"Within the 'parallel architecture' sector (pending the day when France has a low-priced parallel machine which would allow teams to experiment and then to conduct research), we have set the priority of developing a project tailored to our objectives and means, within the framework of systolic architecture where highly inventive algorithm and automatic circuit design studies are being conducted."

"Within the 'networks and distributed systems' sector, we have chosen the SM90 computer as the basic machine, and we are presently seeking cooperation with manufacturers. Five teams are conducting studies on the core systems, communication or remote inquiry protocols and languages suited for distribution."

"The C3 research program focuses on the key concerns of manufacturers designing the turn-of-the-century architecture and systems."

The "language" research objective is to study and develop both asynchronous and synchronous languages for programming systems--frequently imprecisely labeled "real time"--according to the researchers, which either respond to external signals or emit instructions to their environment. This research is still studying patterns for the parallel execution of functional languages.

In "semantics and verification" research, work focuses primarily on the study of models and on software implementation, permitting the building of system types and the verification of some of their characteristic properties.

"Research in the C3 GRECO is of critical concern to manufacturers who are now designing computer architectures and systems for the end of the century. Communications networks and massively parallel architectures are surely the key words in tomorrow's data processing hardware," according to SPI specialists.

Programming: Cooperation With INRIA, Along With Thomson and CGE

The establishment in 1980 of the GRECO which specializes in programming has led to cooperation between the major CNRS laboratories (Bordeaux, Nancy, Paris, Orsay, Toulouse) and other partners, notably INRIA (National Institute for Research on Data Processing and Automation) and manufacturing researchers such as Thomson and CGE (General Electric Company).

"Researchers who have contributed a great deal to theoretical developments now have available to them a set of software whose construction was greatly facilitated by the laboratory equipment policy," according to Jean-Claude Charpentier and his team.

An important point in the technical area: "The development of a number of theoretical projects within mathematical logic has led to major changes in programming techniques, in the mechanisms used by the new languages and in the methods used to develop large-scale software."

The GCIS (Silicon Integrated Circuit Group) is now organized into two groups: technology and CAD circuits.

Next, in the microelectronics area, SPI management once again provides interesting information:

"A 1984 assessment, conducted with all the associates and government authorities involved, confirmed the importance of retaining the present working structure while expanding to better deal with the 'circuits and systems' area. To achieve this we proceeded to a reinforcement of the Multi-Projects Circuit (CMP) procedure, which enables university teams to create average complexity circuits (some 10,000 components) at an acceptable cost and thus to test new architectures."

They also specified that the GCIS now contains two complementary groups:

--in "technology," where main program areas include microlithographic engraving, dielectric oxidation, thin contact films;

--and "CAD-circuits," where objectives include test methodologies, simplified CAD tools, automated design and new digital and analog architectures.

Links both with more basic research and with the manufacturing world appear satisfactory: "The work taking place within the GCIS is a good example of where CNRS's multidisciplinary nature can lead, even as it emphasizes the specialties of the SPI department. It really consists of completed basic research, which calls on various specialists (physicists, chemists, electronic and data processing technicians) closely linked on the one hand with downstream activities (development and manufacturing) and with basic research (for example, microstructure physics)..."

In the area of III-V microelectronics, work has focused on the design, building and analysis of new structures: super networks, heterostructures with modulated doping, etc. A new organization consisting of regional centers (Lille, Paris, Lyons, Toulouse, Montpellier) was adopted to maximize productivity. Since 1984, major new capabilities have been incorporated. On this point the management concludes: "The first test components and structures, only recently on the scene, seem to indicate that the CNRS laboratories have taken an important step allowing them to stay in contact with the international community's best teams."

Pay More Attention to Technological Implementation and Cooperation With Manufacturing

As to overall conclusions, Jean-Claude Charpentier first makes the following observation: "Researchers' evaluations should today be placing a lot more emphasis on technical implementation and cooperation with manufacturers." He

further believes that the "exchange of personnel between the CNRS and manufacturing should be strongly encouraged."

Finally, tending to give up the hope of ever seeing his department represent more than 8 to 12 percent of CNRS--which he believes would be very desirable--SPI's director wonders: "Should we not soon create a very well funded national institute of the engineering sciences, extending beyond the university environment, including specific technical centers and incorporating a management style suited to the specific nature of its task and its needs?"

[Box]

The SPI: A Few Numbers

--144 units (only 13 are CNRS laboratories) three-quarters of which are located outside Paris.

--6,000 researchers--including 950 from CNRS and 2,500 doctoral candidates.

--1,900 engineers, technicians and administrators--including 1,150 from the CNRS.

--An annual consolidated budget of Fr 2.5 billion--of which one-third comes from the CNRS. Half of this sum goes to engineering school laboratories.

--1,500 active contracts.

--13 groups set up with other organizations and companies, including: "Robotics in the Paris region" (Renault, Peugeot, CEA [Atomic Energy Commission]); AI in Languedoc-Roussillon (Elf-Sanofi, IBM, Framentec); National Software Association; Cooperation, Competition, Communication (3C), etc.

25051/12859
CSO: 3698/A286

FUNDING, OBJECTIVES OF EUROLASER PROJECT DETAILED

Turin MEDIA DUEMILA in Italian No 9, Sep 87 pp 82-83

[Text] Brussels--With EUREKA, Europe set out to discover lasers. Various projects in the research program launched by the FRG and France, and in which 19 West European countries are currently participating, aim to challenge the supremacy of the United States and Japan in this area. [This is a sector] of technological development with extremely concrete applications that go well beyond Hollywood-style science fiction fantasies (Fiat, for example, already has some 20 laser cutting systems in its production lines).

Two of the projects involved are closely linked to specific countries. One is an FRG project (Laser applications system) and the other is British (EUREKA 25kW CO2 laser call project). However, a third project is strongly multinational in character with a large Italian presence. Along with British, French, and FRG firms and research centers in the Eurolaser or Industrial Laser project, the Fiar company is the project leader for Italy (some 20 firms, a few research institutes from various universities, the CNR [National Research Council], and ENEA [National Committee for R&D of Nuclear and Alternative Energies] report to Fiar.)

Besides ENEA [and Fiar], the Italian participants include: Alfa Romeo, Ansaldo, Contek, Cfr, Elen, Elettronica Valseriana, Elettrorava, Irvin, Officine Galileo, Quanta System, Rtm, Selenia, Siel-Proel, Snia-Bpd, Scitaab, Valfrive, CNR, CISE, the First University of Rome, and the Second University of Rome. (Footnote 1)

The project aims to evaluate and develop industrial lasers for the processing of products in the following areas:
1--carbon dioxide systems in a power range between 10 and 100 kW,
2--solid-state lasers in a power range between 1 and 5 kW,
3--excimer lasers with a power of up to 10 kW,
4--carbon monoxide lasers with an average power of 5 kW,
5--free-electron lasers,
6--other types of laser systems for medical and industrial applications.

In addition to the Italian firms involved, the list of organizations working on the project includes: the British organizations Fairey Engineering, Ferranti, J.K. Lasers, Welding Institute, and UK AEA Culham; the French firms Cilas (CGE Group) and Crouzet, the French Ministry of Research and Technology;

the FRG organizations Lambda Physik, Leybold Hevaens, Carl Zeiss, Messer Grisheim, ITT, the Max Planck Institute, and the universities of Hannover and Dortmund. The list is not exhaustive. The project has points of contact in the Culham laboratories with research underway within the framework of the EC BRITE program.

The memorandum of understanding that gave rise to this initiative was discussed in Bonn in October 1985, with the understanding that initial expenses were to total 50 million pounds sterling, about 100 billion lire; feasibility studies were to cost 0.4 million pounds sterling. However, costs have now been recalculated and are estimated at approximately 270 billion lire, almost one-tenth of which is to be spent on the definition phase of the projects.

The investment [in the project] was allotted as follows among the four partners from the various countries: 39 percent from France, 25 percent from Britain, 21 percent from the FRG, and 15 percent from Italy; requests for participation and financing have been made to other countries such as Austria, Switzerland, Spain, Greece, Belgium, the Netherlands, and Sweden.

Italian participation in the EUREKA Eurolaser project revolves, as mentioned above, around Fiar [and consists of] some 20 firms, a few university research institutes, the CNR, and ENEA. The latter has already put up its share of the financing, while waiting for government appropriations which should be available through the Ministry of Research.

In a recent statement given to IL SOLE-24 ORE, Alberto Sona, one of the CISE [Center of Information Studies and Experience] personnel responsible for Eurolaser, asserted that Europe-wide involvment is essential at this point for projects of this kind. "The bases for a network of European centers to conduct experiments to develop a common laser technology are becoming more concrete," said Sona. "In reality, the size of the commitment necessary for the development of these technologies must of necessity be European, because no one nation is capable of carrying out projects similar to those already successfully launched by Japan and the United States." This reasoning is similar to the opinions voiced in other scientific research sectors as well.

In technological terms, the project has a number of objectives:
--to improve the efficiency and reliability of lasers and to develop a new [laser] generation;
--to compare laser systems in various health and production sectors, thereby improving certain aspects;
--to reduce the cost of lasers;
--to integrate the laser systems in the overall production system;
--to provide specific supports for operational laser systems;
--to develop an interface to keep up with technology.

From an industrial viewpoint, the project aims to develop carbon dioxide lasers and other application systems, in particular for metal processing in a wide range of production activities. Once the feasibility studies have been completed, work on the project is scheduled to continue for some 10 years, although the first products may be on the market in the next few months.

Carbon dioxide lasers have a gas mix--carbon dioxide, helium, and nitrogen--which produces a laser ray after the mix is excited by an electric charge. These lasers can now reach powers up to 10kW and will be upgraded; Italy hopes to reach 20 kW.

Solid state lasers use crystals, particularly yttrium-aluminum-garnet crystals, within which ions of the rare earth neodymium are excited with a flash of light, subsequently generating the laser ray. These lasers can now reach a power of 0.5 kW and will be upgraded.

Finally, excimer lasers are based on the associati~n of a ~oble gas (argon or crypton) with a non-noble gas (fluor), resulting in a dimer that is stable only when it is excited with an electric charge. Once the state of excitation is interrupted, the two gas atoms are dissociated and emit radiation which forms the laser ray. These lasers can now reach a power of 0.1 kW and will be strengthened.

In reality, the problem for Italy is the precision of the laser rather than the power. Precision is an essential feature for industrial production in Italy, which uses lasers for cutting and welding processes and for heat and photochemical processing.

8615
CSO: 3698/M015

ASEA OF SWEDEN COMBINES HIP, POWDER METALLURGY IN NEW PROCESS

Vasteras ASEA TIDNING in Swedish No 3-4, 1987 pp 12-17

[Article by Bjorn Barnheim]

[Excerpts] Asea Powdermet of Surahammar has developed a new technique for producing molded goods of stainless and high-temperature steels and of so-called superalloys on the industrial scale. The company has developed a method of producing high-quality materials using powder metallurgy and hot isostatic pressing (HIP). This new technique opens up new opportunities for applications in the manufacturing industries that were previously unprofitable or even impossible.

Asea Powdermet's new technique also opens up previously undreamed-of opportunities for creating totally new solutions in materials technology by combining powder of one kind with powder of another kind or powder with an alloy that is produced in a conventional manner. In this way, layers with totally different properties can be built into various parts of a molded product. This compound technique has great possibilities.

Asea Powdermet's new technology is extremely well suited for applications that require advanced materials with high performance characteristics.

Unprecedented

Many of the new alloys that are produced by the new method have no counterpart among conventional special steels when it comes to their properties. They are often extremely difficult to produce by conventional methods, as well.

One example of this is a high-strength stainless ferritic-austenitic steel called APM 2389. It is highly resistant to corrosion, such as stress corrosion and pitting corrosion. Its corrosion resistance is just as high as that of the "best" conventional ferritic-austenitic steels, but the yield strength of APM 2389 is far greater than that of other types of steel with similar corrosion resistance.

By using powder metallurgy and hot isostatic pressing, APM 2389 can be given a high nitrogen content. This provides a yield strength of at least 600 N/mm^2,

which is quite high for hardened ferritic-austenitic steel.

The material is patented and, after extensive testing, it is now being series produced for various applications. Over 50 products weighing 30 to 500 kg each have been produced commercially from APM 2389.

Results With 12-Percent Chromium Steel

Another example is a 12-percent chromium steel, APM 2390-3, a high-temperature material for the turbine industry.

A large number of rings of this material, about 400, have been produced for Asea Stal. Extensive testing has shown that this material possesses greater toughness than that of conventional materials.

Impact strength values up to 100 J can be produced by properly controlling the process. This creates significant potential for increasing the yield strength.

High-cycle fatigue in the form of pulverizing tensile tests on a large number of test rods showed that the fatigue limit of the HIP product, 10^7 loading cycles, is 20 percent higher than that of the conventionally produced material.

Creep resistance is of the greatest importance to the functioning of the material. Creep tests were conducted at 550 and 600 degrees Celsius. The HIP steel clearly has greater creep resistance.

Ultramodern Production Facility

Asea has built an advanced facility in Surahammar. In addition to skilled personnel, there is now an ultramodern plant for the totally integrated production of powder metallurgy products. This is an advanced process.

The material is melted in a high-frequency furnace that has a capacity of 2.5 tons. The composition of the melt is monitored by taking preliminary samples. The composition is adjusted by adding the required alloy elements in a special ladle with a controlled atmosphere.

The liquid steel is then allowed to flow down into an atomizing chamber. A stream of gas meets the steel at a right angle and "breaks up" the liquid steel, forming small drops. The atomization occurs with an extremely low oxygen content in the chamber in order to avoid surface oxidation of the drops.

Rapid Cooling

The drops are cooled at a rate of about 1,000 degrees per second. This limits the solidification reactions that normally occur in a casting, where the cooling time is quite long. Each grain of powder has the same chemical composition as the melt. In addition, an extremely fine crystalline structure is produced by the rapid cooling.

In this way, a material made of powder is completely free of macrosegregations and, in most cases, it is also free of microsegregations. This makes it highly homogeneous. In addition, the material is completely isotropic, i.e. it has identical mechanical properties in all directions.

The powder that is formed is collected in the bottom of the chamber. The grain size varies and before it is poured into closed containers it is screened to 0.5 mm. The mold is then filled with a powder of the alloy in question, the air is evacuated, and the mold is closed.

Free Of Residual Porosity

The mold is then placed into the press (a high-pressure furnace, for example), where it is subjected to high temperature and pressure. The material is then compressed by hot argon gas under high pressure, which acts uniformly from all directions on the mold. The mold shrinks uniformly by 10 to 12 percent in all directions due to plastic deformation of the powder grains.

A material that is produced from gas-atomized powder by hot isostatic pressing is completely air-tight, i.e. all porosity is eliminated. During compression, the surfaces of the powder are bonded together.

Because of the high temperatures that are produced during pressing, metal atoms migrate across the boundaries between powder grains. In this way, the forces and the bonds between metal atoms on both sides of the boundary are the same as they are within a powder grain.

The pressing is carried out in the world's largest hot isostatic press, an Asea Quintus press. It has a diameter of 1,470 mm and the volume of its furnace is about 5,000 liters. The maximum temperature is 1,250 degrees Celsius and the maximum pressure is 140 MPa (1,400 bar).

Adjustment

The temperature during pressing is well below the melting point of the material but, at the same time, it is sufficiently high for the powder grains to become plastic and deformed under the influence of the pressure. A lower temperature and a longer pressing time are chosen if the fine crystalline structure of the powder grains must be retained. In this case, there is time for atomic bonding to occur through diffusion across powder grain boundaries.

9336
CSO:36980616

FRG FIRMS DEVELOP NEW CIRCUIT CARD PRODUCTION METHOD

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 463, 14 Sep 87 pp 6-7

[Text] Printed circuit boards for electronics currently produced by carrying out several "wet" processes will be made in the future using a single dry processing method developed by the Fraunhofer Institute for Surface Layers and Bioprocessing Technology in cooperation with the Fraunhofer Institute for Manufacturing Technology and Automation, both from Stuttgart, and the company Irion & Vossler (IVO). With this method it will be possible to print complete circuit configurations onto thermoplastic substrates in a single process lasting only a few seconds.

Traditional production techniques for printed circuit boards involve the use of a basic material such as a laminated copper foil based on a fiberglass reinforced epoxy surface on which a protective film in the shape of the conductor image is positioned using a photo resist or a filter pressing technique. In the subactive process [Substaktiv Verfahren], the unprotected copper is corroded so that the chosen conductors remain in place. In the other classical production method, the additive process, the protective film covers all the surfaces of the basic material which are not to be used for circuit tracks. This is followed by activation on the recessed [ausgesparten] surfaces, chemical copper separation, and finally a galvanic reinforcement of the copper layer.

Both methods and their variations require more than ten "wet" process steps, such as layering, corrosion, separation, cleansing, and so on. On the other hand, the new procedure consists in only one single "dry" working process, hot printing.

The key element is a 4-layer composite hot-press printing foil made of carrier, circuit, copper, and adhesive layers. This is pressed onto the thermoplastic substrate by means of a heated seal whose surface exposes the whole circuit image inverted on a sample in relief 0.6 to 1 mm high. The tracks then separate from the copper leaf, dissolve from the carrier layer and adhere to the substrate. After the withdrawal of the seal, the carrier band cleans the workpiece of all the unused copper leaf that was not exposed to the printing press. This makes collection of the unused copper easier than in the chemical etching processes. The printed copper tracks can be tinned and soft-soldered without further pretreatment or cleansing.

The precision and error rates of the circuit that can be obtained today correspond to those that can be obtained in the filter pressing process, that is, 0.2 to 0.3 mm. Since the margin sharpness is better than in the corroded conductor paths, the electric breakdown strength is higher. Suitable materials for the substrate are thermoplastic products such as semi-finished products, pressure casting parts, flexible foils, or boards adaptable to the application conditions of the circuit networks.

8613
CSO: 3698/M034

BMFT ANNOUNCES SUBSIDIES FOR MICROSTRUCTURE RESEARCH

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 461, 13 Aug 87 pp 8-9

[Announcement of the "Subsidy Plan for Microstructure Technology" within the Subsidy Plan for Physical Technologies, 13 July 1987]

[Text] 1. Scope of the Subsidy Plan

Microstructure technology relates to the production, the geometrical and physical alteration, and the characterization of lateral and vertical structures smaller than 20 micrometers in at least one dimension. It is considered as an applications-oriented transfer of the results obtained in microstructure research to new products and economic processes--in addition to microelectronics and microperipherals (sensors, actuators, manufacturing and assembly technologies).

2. Objectives of the Subsidy Plan

The subsidy of microstructure technology has the following objectives:
--to improve and maintain the competitiveness of FRG industry in this technological field at the international level;
--to acquire a broad basis of competitive know-how, with forward-looking preliminary research and development [carried out] in close collaboration with research organizations and industry;
--to exploit the technological potential of microstructure research and the innovation opportunities it offers for new products and economic processes in such fields of application as manufacturing and processing technologies, energy and environmental technology, and biomedical technology.

3. Theme of the Subsidy Plan

Subsidy of applications-oriented research and development projects primarily involves the following areas of activity:

a) New or further development of methods aimed at the programmed production of microstructures.

This field covers developments and applications of microstructural processes and structural transfer techniques; examples include ion-beam

techniques, physico-chemical and electro-chemical processes, and processes adapted from semiconductor techniques and modified accordingly. Utilization of production processes must aim at the development of desired products, such as X-ray optics components, microfilters or general components and component parts with specific characteristics.

b) Development of methods of analysis and measuring techniques for the characterization of microstructures.

Work in this field must aim at the development of physical analysis methods and measuring techniques for the microstructural, molecular, and atomic characterization of inorganic and organic materials. This implies instrumental and technical developments of methods for specifying reflecting elements in the application of, for example, electromagnetic radiation, ion, neutron, and electron beams, and acoustic signals. This also includes the development of components for equipment such as precision focusing radiation sources, high resolution analyzers, and detectors.

Restrictions

The subsidy does not apply to:

--the development of methods and applications of microstructural and structural transfer techniques used primarily in the production of microelectronic and microperipheral components (see BMFT Subsidy Plan No 23 "Microperipheral"), as well as component parts for information technologies and software components;

--instrumental and technical developments of analytical methods and measuring techniques when their application aims primarily at the manufacture and quality control of microelectronic structural elements and components;

--development of procedures and techniques related to the analysis of microscopic surfaces and volumes;

--further developments in electron microscopy in particular, as long as the techniques involved are not essentially new.

In general, subsidies will not be allocated to research and development projects already being subsidized by other organizations (for example, the Volkswagen Foundation's "Microstructural Sciences" subsidy program).

4. Terms of Subsidy

Subsidies are granted to industry and research institutes for R&D projects of outstanding interest involving high technical and economic development risks, but which are of national interest as regards the expected results. Priority will be given to the subsidies for joint projects involving cooperation by research institutes and companies and with common objectives. In principle, individual projects undertaken by commercial organizations of research

institutes can be subsidized.

In general, subsidies for R&D projects amount to:
--50 percent of the total costs for companies;
--100 percent of the total cost for research institutes.

In order to promote the most effective collaboration between industry and research institutes, it is suggested that firms contribute to the expenses of the institutes.

5. Information and Advice

Further information as well as technical and organization advice can be requested from the VDI Technology Center for Physical Technologies, Duesseldorf.

Bonn, 13 July 1987
423 - 7111 - 2/87

8613
CSO: 3698/M437

EC COMMISSION ISSUES PROPOSAL FOR ESPRIT II

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 461, 13 Aug 87 p 13

[Preliminary Communication for the 1987 ESPRIT Tender]

[Text] The EC Commission recently submitted Phase II for ESPRIT, the European Strategic Program for Research and Development of Information Technology to the Council of Ministers. ESPRIT was first launched in 1984 by the Council of Ministers and currently includes more than 200 "pre-competitive" research & development projects in information technology for a total cost of 1.4 billion ECU's.

The Community's general program "Research and Technological Development" (1987-1991) will probably be approved soon by the Council of Ministers. The Community's funds for information technology amount to about 1.6 billion ECU's. The Commission is planning to use these funds for the second phase of ESPRIT in order to carry out R&D projects with a total cost of more than 3 billion ECU's. After approving the general program, the Council of Ministers is expected to deal urgently with the second phase of ESPRIT.

The Commission's proposal for the second phase of ESPRIT will be published in the European Community's gazette. The call for bids for project proposals, which must comply with the work program, will also be published in the gazette immediately after the Council's decision. The Council's decision is expected to be taken before the end of 1987. Another call for bids for basic research initiatives will be published in 1988.

The objective of the Commission's present preliminary communication is to help applicants in their planning and to make the necessary documentation available to them. The necessary application form can be requested from TECHNOLOGIE NACHRICHTEN offices. An "ESPRIT Proposers' Day" presentation to applicants will be held on 2 October 1987 as part of the ESPRIT annual conference.

Applicants can also use EUROCONTACT which helps in the search for project partners. EUROCONTACT is a databank open to the public containing information on organizations looking for partners for R&D. The EUROKOM "Electronic Mail" system is the ESPRIT communication system and can be used by anybody interested in the ESPRIT program. Information on these two communication systems can be obtained from the EC Commission in Brussels, GD XIII, ESPRIT

Operations Office, A25 7/11, Rue de la Loi 200, B-1049 Brussels.

Applicants needing the work program and the application forms ("Information package") as soon as they become available are requested to fill in the abovementioned application form and return it to the EC Commission (see above address).

8613
CSO: 3698/M439

EC SUPPORTS PILOT PROJECTS FOR INFORMATION SERVICES

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 461, 13 Aug 87 p 12

[Pilot Projects For Information Services]

[Text] The EC commission is currently defining a plan of action dealing with different specific initiatives. For this purpose, it has entered into firm discussion with the representatives from member countries, the information industry, and information users.

One of the major objectives of this plan of action will be to conduct a limited number of highly interesting pilot or demonstrative projects which must be defined and carried out in close collaboration with the information industry and users.

In this call for tenders, the commission is inviting the industry and users to submit ideas for pilot or demonstrative projects of this kind or to propose fields in which they could be carried out.

In the formulation of project ideas, the commission considers the following aspects important:
--The projects must contribute to the creation and implementation of a European Community information service.
--Priority will be given to cooperative projects involving multiple participation (several links of the information chain) and which are supranational (that is, different member states participate) in order to provide the projects with diverse know-how.
--The projects should be well defined so as to provide a positive effect in the development of an information market at the Community level, and in any case to go beyond the interests of one single participant at the national level.
--Cooperation between KMUs [as published] with special skills and leading companies is welcome.
--As far as possible, projects should make use of existing technology infrastructures and transfer electronic information products and services on machine-readable storage mediums.
--Norms already in existence or currently being planned should be considered.
--Projects must be directed at feasible market areas and must promote the breakthrough of potential new marketable information products and services

both within and outside the Community.

- --Particular emphasis is to be placed on simplifying access to databank services that are important to uneducated users, in particular such as KMUs (projects aiming at the development of third generation information services).
- --Part of the projects should contribute to reducing the discrepancies in the activities of member countries in the information sector.
- --Furthermore, some projects should aim at acquiring customers in the public sector and particularly in international institutions and organizations so as to attain high standards from the very beginning.
- --Special emphasis will be placed on the promotion of plans aimed at the improvement of user services.
- --Actions for financing, assessing, and diffusing results must be an integral part of the projects.
- --Cooperative groups must be well defined and must be composed of sufficiently large user groups from several members of the Community where the multiplicity of languages in these user groups must be taken into account.
- --Projects may not raise fears that they will compete with information services on the market.

Further information can be obtained from the EC commission, General Management for Telecommunications, Information Industry, and Innovation, General Management XIII-B-1.

8613
CSO: 3698/M438

EC BASIC RESEARCH PROGRAM UNDERGOING FURTHER REVISION

Duesseldorf VDI-NACHRICHTEN in German No 33, 14 Aug 87 p 2

[Article by Rolf Spitzhuettl: The Programs Are Still at the Starting Point; first paragraph is VDI-NACHRICHTEN introduction]

[Text] VDI-N, Brussels, 14 August 87--At last, after difficult consultations and 6 months' delay, the EC Council of Ministers gave the go-ahead at the end of July for the basic research program. However, it was not a clear signal for the commencement of the planned establishment of a European technology association. The actual start is expected to be given by the EC Commission in Brussels in November.

This time the cause for the renewed delay is the European Parliament. In mid-September and after the decision of the competent committee, the Assembly will decide whether it wants to call for a formal discussion of the program with the Council of Ministers. In this case the Council of Ministers--probably the Council of Research Ministers who will meet on 28 September and then again on 30 November in Brussels--would have to meet again with a parliamentary delegation. In Brussels, the Commission is not expecting any changes in the financial package or in the content of this compromise which [in fact] was difficult enough to reach. At this point in the proceedings, the Council could reject any changes parliament wanted to make.

The situation is somewhat different as far as individual projects are concerned, since their remittal to the Council of Ministers does not require a majority vote. If by any chance the Parliament decides to make some modifications in September in the medical research program, in the project for research and political cooperation with developing countries, or the RACE program (telecommunications technologies), the Council of Ministers will not prevent it.

Awareness of the Parliament's increased decision-making rights and the possibility of postponing individual programs with a majority vote was precisely what induced the major EC countries to continue bargaining over the basic program until the very last moment. After the reform, this was their last opportunity to try and convince undecided parties by threatening a blockade--perfectly aware of the fact that the Parliament and smaller member countries were in favor of including other research and political projects in the European policy. And then there was also the final financial compromise

imposed by Britain.

The financial cost of the global 5-year program will total about 6.5 billion European Currency Units [ECU's] about 1 billion ECU's of which (1 ECU = DM2.1) have already been assigned in credits but not yet disbursed. Of the remaining 5.4 billion ECU's, 417 million have now been set aside and frozen on British request. Whether London will allow this sum to be unfrozen will depend on basic decisions in internal politics taken by the Council of government leaders in December in Copenhagen. Although this has caused delays in the formal approval--and to some extent in the financing--of the global program, the Commission has already started to take action. The Cabinet of the present EC Commissioner Karl-Heinz Narjes has declared that in the meantime "urgent allocations" have been granted the RACE program and a "call for tenders" has been issued for the ESPRIT program. About DM3.5 billion are available for the ESPRIT program and DM1.2 billion for RACE for the period 1988-1992.

The ESPRIT program for pre-competitive research includes three fields of application:

1. Microelectronics and technology of peripherals (highly integrated circuits, high speed integrated circuits, multifunction integrated circuits, peripheral technology).
2. Information processing systems (system layouts, data processing, system architectures, and signal processing).
3. IT application techniques, computer integrated manufacturing, integrated information systems, and application support systems. But nothing will be decided before the meeting of the Research Ministers on 30 November.

8613
CSO: 3698/M440

CIPI APPROVES ITALIAN R&D PROJECT FUNDS

Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian No 215, 15 Sep 87 pp 15-17

[Editorial Report] Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian on 15 September 1987 publishes resolutions adopted by the Interministerial Committee for the Coordination of Industrial Policies [CIPI] concerning the admission of Italian industrial research projects to the Special Fund for Technological Innovation established by Article 14 of Law 46 of 17 February 1982. In CIPI's 6 August session, the following company projects were admitted to the fund:

Fiat Auto S.p.A., large company classification.
Program: product and process innovation in the design and testing of outer panes in composite materials.
Eligibility (ex article 16, law 46/82): resolution of the Minister for Industry of 8 May 1987.
Place of execution: Turin.
Form of financing: easy credit available at an annual interest rate established by article 15, law 46, of 17 February 1982. Subsidy provided under the third sub-paragraph of article 15, law 46, of 17 February 1982.
Maximum amount: a) easy credit: 27.5 percent of the allowed costs of 2,591.6 million lire. b) subsidy: to be established by the Ministry of Industry on the date of stipulation of the contract as established by the third sub-paragraph of article 16, law 46/82, on the basis of 27.5 percent of the allowed costs, to be calculated according to the procedure established by article 15 of the aforementioned law.
Amortization: 10-year amortization in addition to the 5-year period of utilization and preamortization starting from the date of stipulation of the contract.
Starting date of the program: 1 January 1985.
Estimated data of program completion: 30 June 1990.

Ing. C. Olivetti & C. S.p.A., large company classification, in the name and on behalf of the companies Alitec S.p.A., Modinform S.p.A., OCN S.p.A., and Diaspronsud S.p.A..
Program: product and process technology innovation for components and accesories for office and factory automation.
Eligibility (ex article 16, law 46/82): resolution of the Minister for Industry of 8 May 1987.

Place of execution: Pozzuoli (Naples), Marcianise (Caserta).
Form of financing: easy credit available at an annual interest rate established by article 15, law 46, of 17 February 1982. Subsidy provided under the third sub-paragraph of article 15, law 46, of 17 February 1982.
Maximum amount: a) easy credit: 27.5 percent of the allowed costs of 2,148.75 million lire to be allocated to the South. b) subsidy: to be established by the Ministry of Industry on the date of stipulation of the contract as established by the third sub-paragraph of article 16, law 46/82, on the basis of 27.5 percent of the allowed costs, to be calculated according to the procedure established by article 15 of the aforementioned law.
Amortization: 10-year amortization in addition to the 5-year period of utilization and preamortization starting from the date of stipulation of the contract.
Starting date of the program: 1 May 1985.
Estimated date of program completion: 31 December 1987.

STARS S.r.l., large company classification.
Program: product and process innovation for high productivity processes for polymers in bodywork panels.
Eligibility (ex article 16, law 46/82): resolution of the Minister for Industry of 8 May 1987.
Place of execution: Villastellone (Turin).
Form of financing: easy credit available at an annual interest rate established by article 15, law 46, of 17 February 1982. Subsidy provided under the third sub-paragraph of article 15, law 46, of 17 February 1982.
Maximum amount: a) easy credit: 22.5 percent of the allowed costs of 2,657.969 million lire. b) subsidy: to be established by the Ministry of Industry on the date of stipulation of the contract as established by the third sub-paragraph of article 16, law 46/82, on the basis of 22.5 percent of the allowed costs, to be calculated according to the procedure established by article 15 of the aforementioned law.
Amortization: 10-year amortization in addition to the 5-year period of utilization and preamortization starting from the date of stipulation of the contract.
Starting date of the program: 1 January 1986.
Estimated date of program completion: 30 June 1990.

8616
CSO: 3698/M012

ENEA DIRECTOR ASSESSES PROGRESS OF EUREKA PROGRAM

Turin MEDIA DUEMILA in Italian No 9 Sep 87 pp 86-91

[ENEA Director Fabio Pistella Discusses EUREKA Program: "EUREKA: Illusion or Success?"

In general, when the launch of a difficult project is met with great enthusiasm, there is a high probability that when the time comes for the final balance, we are faced with disappointment. The exact opposite has happened with the EUREKA initiative, launched by [French President Francois] Mitterand to stimulate collaboration between European companies working in the field of high-technology. The program started off in an atmosphere of skepticism and criticism, but this initial attitude was quite radically overturned in light of the concrete results achieved after little more than a year and a half: over 100 European cooperation programs for a total of over 5.5 trillion lire had already been launched by December 1986, and it is reasonable to assume that the next conference of the foreign and research ministers of the 19 European countries together with the European Community Commission of the EUREKA participants, set for September in Madrid, will launch a further 40 programs for a total of over 1 trillion lire.

Another forecast regarding the political-diplomatic aspects, but seemingly rather "mythological" has been duly denied by the facts: the expecteed French-FRG axis did not come to pass. On the contrary the number of programs involving both French and FRG companies is fairly small, and Italy, thanks to the number of programs in which it participates and the extent of the country's financial commitment, ranks second in the EUREKA program after France.

The advanced technology sectors covered in the collaborative program range from robotics to lasers, new materials to biotechnology, and microelectronics to information. The production sectors relating to these technological developments vary from telecommunications to transportation, health, and the environment, and from automatic factories to the utilization of marine resources. The types of program participants are also varied. Some of the companies belong to large groups, while others are small and medium-sized companies; there are also a small number of research organizations.

A characteristic that is common to almost all the programs is the objective of internationally marketing innovative products (goods and services) made by the

European companies (even if these innovations are limited to the production processes), and which are competitive against the United States or Japan. Each program is based on an initiative from industries in the various countries, agreeing on a common program and combining their financial resources and technological capabilities in a system of fully autonomous decision making. The system is managed at "grass roots level," that is, there is no supreme authority (national or international governmental organizations) empowered to establish precise program procedures or approve company proposals. At the ministerial conferences, it was no coincidence that the word "launch" was used rather than "approval" in connection with the programs. The EUREKA organizations, the committee of high level government representives, and the ministerial conferences establish the rules of the game and verify that the program proposals satisfy certain very general directives, the most important one of which concerns the non-military nature of the products to be developed.

However, it would not be very realistic to attribute--as some people do on a wave of "Thatcherism"--the success of the EUREKA initiative exclusively to this anti-management approach. Europe has been and still is ready for a more international production system. This need is based on a number of well-known reasons concerning the insufficient size of the present production organization and the possible synergies to be obtained from an integration process. EUREKA represents an opportunity to further this [process of] aggregation, as has been happening in the company mergers and strategy agreements that we have recently been seeing so frequently.

One should not ignore the effects of the initiative's positive evolution on the availablility of public funding to companies in many countries for the EUREKA project. This public support, which often represents 50 percent of the total program cost,is motivated primarily by the high risk of failure of the program itself. This [risk] is due both to technological difficulties and to the uncertainty of the developed product's commercial success.

The reason for the limited participation of private financial organizations in financing the EUREKA program is the high risk involved. It will be difficult to reverse this trend unless a guarantee mechanism is introduced, or at least until the risks involved are reduced by using public funding in some way. International studies are being carried out on such mechanisms, providing for the use of public resources not as contributions to the capital account but as a means of lowering interest rates and covering costs associated with the risks--since the capital is provided from the normal capital market.

As far as public funding in Italy is concerned, law 22 of February 1987 put forward by Research Minister Granelli, made available to Italian companies an amount not to exceed 10 percent of the total amount available from the "Special Fund for Applied Research" established by law 46 of 17 February 1982, for the development of applied research projects within the framework of

international cooperation. The total amount provided for 1987 is 120 billion lire.

It is natural to wonder whether the role of governments in this process of unifying Europe's technology development activity should be limited to providing a meeting point for technology grants (a "matrimonial agency," some say) and to providing a financial incentive to companies for developing the programs.

It is easy to see that this is not enough. Further action is indispensable if we wish to create a European system on a level with the global competition that characterizes the current industrial trend and at a more general level, the economic situation. This regards the question of market demand. It is not enough to facilitate the quality and aggregation of the offer, it is also necessary to remove all obstacles standing in the way of establishing a balanced market on a continental scale. These include variations in procedures and standards among the various countries, and the fragmented and in some cases protectionist policies used by governments.

At a more general level, in several infrastructural sectors such as telecommunications, transportation, and the environment, public authorities must be in a position to launch and manage complex systems whose definitions and developments are well beyond the capabilities of individual companies. It is comforting to know that the EUREKA participants are now becoming firmly convinced that top priority should be given to programs related to the infrastructure sectors, an opinion that Italy has held from the start.

Italy's position, or rather example, has also been successful in another issue concerning the role of government agencies. In complex programs, a number of both small and medium-sized firms have joined with a public agency, [and this association] constitutes the Italian partner. Working along these lines, ENEA has offered its technical know-how and capabilities in the structuring and management of complex programs, and has made it possible for Italian companies to take part in a large number of programs in a more coordinated way, with more significant roles and greater negotiating powers. Of these programs, we should mention [the programs for] the development of the high power laser, the development of the robot for the diagnosis of accidents and intervention in hostile environments, the development of marine robots for the support of plants, and installations of various kinds.

Among the ways adopted by ENEA for operating systematically include the close cooperation with industrial companies through the pooling of material as well as financial resources, and the creation of infrastructures for the qualification of components and other technological services of common interest. This is particularly true with regard to the transfer activities of advanced technology companies, even those activities in the more conventional sectors that the center has acquired for implementing its programs in the

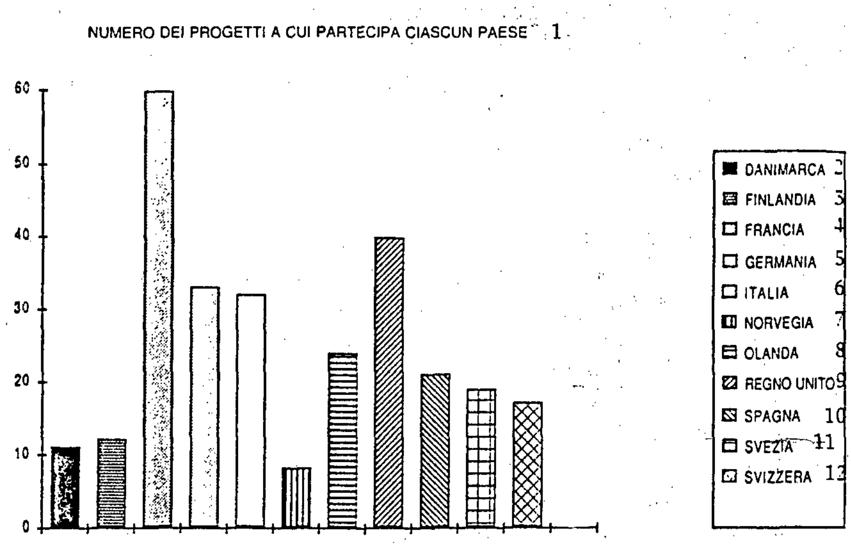
energy sector. It should be noted that this sector, (which includes, for example, nuclear fission and the fuel cycle) requires full mastery of technology sectors such as lasers, robotics, microinformatics, the utilization of high power radio-frequency waves, and high temperature materials which are at the heart of the transformation process which is taking place in the production sector today.

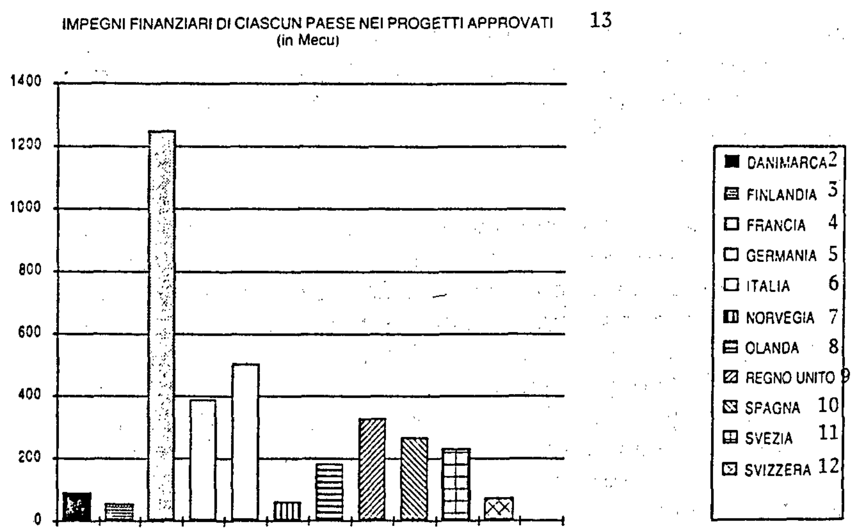
The role of a public agency with technological-scientific capabilities such as ENEA is particularly significant with regard to projects relating to infrastructure, such as the environment, that are not directly connected with the markets. In this sense, ENEA operates as leader of the Italian participation for the environment side of the EUROMAR program. The objective of this program is to define an innovative advance in marine technology. This technological effort is aimed at providing correct ecological evaluations, as well as identifying the trends in the evolution of the marine environment--both with regard to social and economic development and in the long term, the frightening climatic changes which could alter the environmental balance in the next century.

It is rather difficult to forecast EUREKA's ability to influence the production activities in use, say 10 years from now. However, we can say that much will depend on the successful implementation of the objectivies set by the "Single European Act" which aims at forming a single internal market for the Common Market members by 1992.

Still in the framework of community actions, it should be particularly noted that as part of the research activities of the ESPRIT, BRITE, and RACE programs, and side by side with their main objectives, a series of contacts and collaborative programs have been established between the industrial representatives and the Community. However, it would be advantageous if rather than hold back the program, the significant R&D efforts mobilized by EUREKA were to supply a further element of persuasion and impetus to the governments of the European Community countries. Once these authorities have reached a definitive decision on the future of Community programs, they will then be able to continue to promote concrete reform initiatives of the community research system, aiming at a greater influence and higher levels of efficiency.

Chart 1:

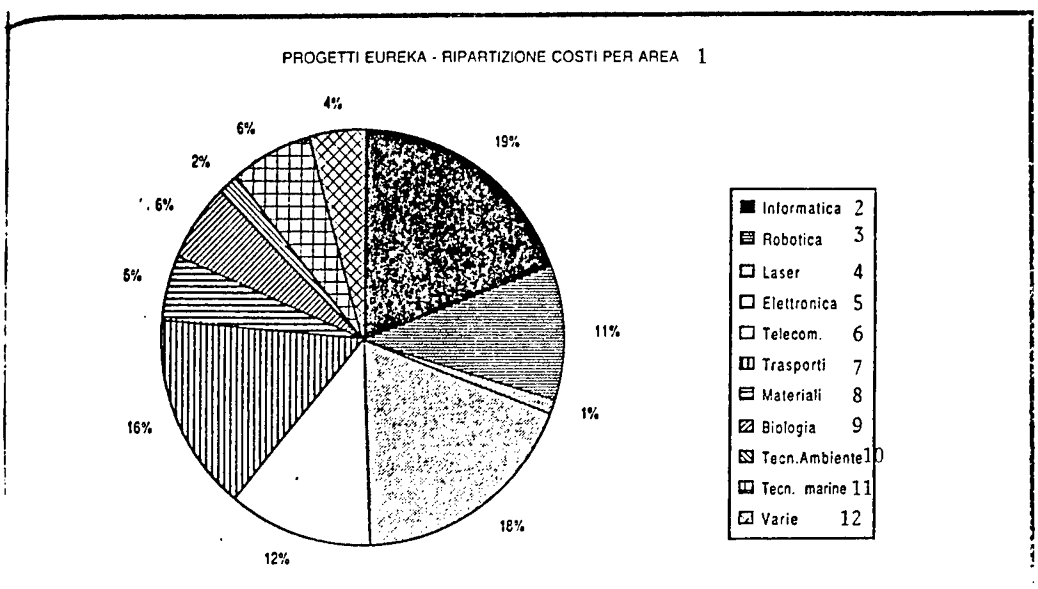




Key:

1. Number of Programs Per Country
2. Denmark
3. Finland
4. France
5. FRG
6. Italy
7. Norway
8. Netherlands
9. United Kingdom
10. Spain
11. Sweden
12. Switzerland
13. Finacial investments per country in approved programs (in millions of ECU's)

Chart 2



Key:
1. Eureka Programs: Costs Per Sector
2. Data Processing
3. Robotics
4. Lasers
5. Electronics
6. Telecommunications
7. Transport
8. Materials
9. Biology
10. Environmental Technology
11. Marine Technology
12. Various

Table 1

PROGETTI EUREKA VARATI NELLE CONFERENZE 1
DI HANNOVER, DI LONDRA E DI STOCCOLMA
Costo complessivo dei progetti ripartito per aree tecnologiche* 2
(in miliardi di lire)

Aree Tecnologiche 3	N. Progetti 4	Costo 5 complessivo	Costo medio per progetto 6
Informatica 7	22	1.032	47
Elettronica 8	16	965	60
Telecomunicazioni 9	8	628	78
Tecnologie dei trasporti 10	7	845	121
Robotica e sistemi avanzati di fabbricazione 11	11	566	51
Laser 12	5	59	12
Tecnologie del mare 13	3	340	113
Tecnologie per l'ambiente 14	2	100	50
Tecnologie per la biologia e la medicina 15	14	306	22
Nuovi materiali 16	11	267	24
Varie 17	9	224	25
Totale 18	108	5.332	49

* Per alcuni progetti è stato considerato solo il costo della fase iniziale di definizione essendo l'unico attualmente definito. 19

Key:
1. Eureka Programs Launched at the Hanover, London and Stockholm Conferences
2. Total Cost of Programs by Technology Sector* (in billions of lire).
3. Technology Sector
4. Number of Programs
5. Total Cost
6. Average Cost per Program
7. Data Processing
8. Electronics
9. Telecommunications
10. Transport Technology
11. Robotics and Advanced Manufacturing Systems
12. Lasers
13. Marine Technology
14. Environmental Technology
15. Biological and Medical Technology
16. New Materials
17. Various
18. Total
19. *Only the cost of the initial definition phase of some programs has been considered since it is the only one defined at the present time.

Table 2

PROGETTI EUREKA A PARTECIPAZIONE ITALIANA 1
Costo complessivo dei progetti ripartito per aree tecnologiche* 2
(in miliardi di lire)

Aree tecnologiche 3	N. progetti 4	Costo 5 complessivo	Quota italiana costo 6	% 7
Informatica 8	3	212	48	23
Elettronica 9	1	587	293	50
Telecomunicazioni 10	4	342	16	5
Tecnologie dei trasporti 11	4	745	133	18
Robotica e sistemi avanzati di fabbricazione 12	7	446	145	32
Laser 13	2	38	7	18
Tecnologie del mare 14	1	240	29	12
Tecnologie per l'ambiente 15	1	99	10	10
Tecnologie per la biologia e la medicina 16	5	106	34	32
Nuovi materiali 17	1	23	4	17
Varie 18	3	62	16	26
Totale 19	32	2.900	735	25

* Per alcuni progetti è stato considerato solo il costo della fase iniziale di definizione essendo l'unico attualmente definito 20

Key:
1. Italian Participation in Eureka Programs
2. Total Cost of Programs by Technology Sector* (in billions of lire).
3. Technology Sector
4. Number of Programs
5. Total Cost
6. Share Cost
7. Italian Percent
8. Data Processing
9. Electronics
10. Telecommunications
11. Transport technology
12. Robotics and Advanced Manufacturing Systems
13. Lasers
14. Marine Technology
15. Environmental Technology
16. Biological and Medical Technology
17. New Materials
18. Various
19. Total
20. *Only the cost of the initial definition phase of some programs has been considered since it is the only one defined at the present time.

8618
CSO: 3698/M016

FRG ROLE IN NEW EUREKA PROJECTS OUTLINED

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 463, 14 Sep 87 pp 11-13

[Text] The EUREKA program, originally a French-FRG research initiative, is now reaching its peak growth, with 69 new projects. The total cost of the projects--which now total 177--has increased to about DM9 billion. The expectation of progressive expansion of supranational cooperation in Europe over EUREKA has thus been confirmed, explained Federal Research Minister Riesenhuber in anticipation of the fifth EUREKA Ministerial Conference which will take place on 14-15 September 1987 in Madrid under Spanish patronage.

While the sector of information and communication technology was originally predominant, production techniques and material research have now shown the greatest growth. FRG and research institutes participate in 17 of the newly adopted EUREKA projects. The number of EUREKA projects with FRG participation has thus increased to 50, with a total cost of over DM3 billion and FRG financial participation of over DM1 billion.

Laser technology is one of the priorities among these 17 new projects (with four projects in different technological development lines with power ranging of from 1 to 20 KW). This will make a new series of material processing innovations available to manufacturing technology. Medical technology is another important topic, with three projects; this is a field that so far has had scant representation in EUREKA. Among others, the following projects have been considered:

--PHOEBUS: the objective is to bring the technology of solar power stations into a competitive position with regard to other energy producing methods;

--EUROFAR: the objective is to optimally combine the positive properties of aircrafts and helicopters in air transport;

--Optical broadcast systems: important for future data exchanges.

In the 17 new FRG projects, there are for the first time a number of projects (nine) for which the FRG financial contribution will come exclusively from industry, that is, without government subsidies. For example:

--EUROPEAN COMMON LISP, a development of COMMON LISP, a higher programming

language for expert systems based on European standards (EU 157);

--Carrier mediated therapy, a development of a set cancer diagnosis and therapy using hormones or antibodies as carrier of the medical station (EU 181);

--Development of new methods for steel production, such as a reduction in rolling processes in the production of sheet steel through direct pulling on the cylinder during the casting process (EU 206).

Only 30 of the 50 projects with FRG participation will be granted subsidies from the BMFT [Federal Ministry for Research and Technology] technical programs, at a total cost of about DM600 million over a period of 3 to 8 years. This also includes the financing of government-related activities that are not usually carried out by industry, such as environmental research and infrastructure development at the European level (BMFT contribution: over DM200 million).

Further incentives are expected from various initiatives [taken] by industry to subsidize European technological projects. In this context it should be mentioned that a round-table of European banks, formed by Deutsche Bank spokesman Doctor Herrhausen, has lately been extensively involved in these new areas of finance and is planning to propose special financing plans for specific projects. The Union of European Venture Capital Companies is also pursuing similar goals. They both operate information exchanges with the EUREKA secretariat and the national coordination offices in their respective countries.

In Madrid, the EUREKA secretariat will present the newly acquired databank which in the future will make all important information on EUREKA projects (scope, content, participants, and interested partners) available to interested parties and to the public.

Federal Research Minister Riesenhuber regretted the EC Commission's reluctant participation in EUREKA projects and expressed the hope that once the general program was adopted, the commission would substantially increase its involvement.

EC commissioner Karl-Heinz Narjes responded to this criticism by commenting in the HANDELSBLATT (No 174, 11-12 September 1987) that he had the impression that the level of information at the Ministry of Research was not the best. Brussels was open to new projects and was acting "in a businesslike manner." In his opinion, since EUREKA reflects real market conditions, compliance with EC competition regulations must be controlled. Joint ventures between companies should not be favored simply because they comply with the EUREKA requirements, to the detriment of other companies which produce the same products, but for some reason do not comply with these conditions.

EUREKA Projects

Two years after the foundation of the European research initiative EUREKA, there is still a certain vagueness concerning the "who, what, when, and how" of EUREKA. EUREKA is still little known by medium-sized industries, for example. The brochure "EUREKA for Europe," recently published by the DIHT [FRG Industry and Commerce Association] will fill this lack of information. The brochure presents the reports and discussions held at the DIHT EUREKA conference in December 1986 and explains how EUREKA works, how projects are implemented, and how one becomes a project partner. Single project groups such as environmental technology, new materials, robotics, and laser technology are presented. "EUREKA for Europe," 90 pages, price DM8.50 (registration tax). The brochure can be requested from the IHK Koblenz BITT (Information Office for Innovation and Technology Transfer).

8613
CSO: 3698/M035

FRG INDUSTRIAL GROUP EXAMINES THE 1990'S SUBSIDY POLICY

Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 462, 28 Aug 87 pp 2-3

[Excerpt] The summary of a discussion session held during the general AIF [Confederation of Industrial Research Associations] meeting in mid-May has been published by the association in the latest edition of its "Research and Development" series. According to this summary, contributions by representatives of the Federal Ministry of Trade and Industry and the Ministry of Research, and by representatives Professor Laermann (FDP) [Free Democratic Party] and Dr John von Freyend, a member of the central management of the Federal Association of German Industry, revealed a rough outline of R&D subsidies in the 1990's:
--About 50 percent of federal funding for the subsidy of innovative activities in small and medium-size companies will be cancelled;
--The program for the subsidy for R&D personnel, now in its final phase, will probably not be renewed;
--An investment subsidy is available, according to paragraph 4 InvZulG [as published], and in any case, the special write-offs for R&D investments will end by 1989 (payment year);
--Preference is given to cooperative research and combined research, which may be subsidized more heavily;
--Establishment of technology-oriented companies will continue to be subsidized;
--More attention will be paid to technology exchanges--and to cooperation between industry and science as one of its elements.

Although no mention was made of program details, budget proposals, or other informative planning data, contrasts in science policies were clearly visible [from the comments made] during the AIF discussions.

As a representative of trade and industry, Dr Eckart John von Freyend was of the opinion that the tax reform, totaling a net credit of approximately DM3-4 billion for trade and industry, would have only a limited effect on the investment capabilities of companies, and that small and medium-size companies in particular would have few benefits.

FDP representative Professor Laermann thought that tax measures would produce advantages for companies by raising the number of options for investment decisions. Nonetheless, he questioned what really remained available for R&D

subsidies, and what definitions should be used in the future.

Cabinet minister Hohn, in charge of basic issues in pure research policy in the Federal Ministry of Trade and Industry, indicated that it was the opinion of his ministry that 10 years of wide-ranging expense oriented subsidies for R&D have provided sufficient impulses, and that attempts should now be made to compensate for a future lack of funds by the qualification and upgrading of (subsidy) instruments.

Nobody wanted to specify the existing subsidy measures or to introduce new ones. But the intention to let the substantial subsidies given to innovative small and medium-size companies be used almost simultaneously was definitely criticized. The President of the AIF, Professor Otto H. Schiele, made the following statement:

"I do not argue that one or the other program was intended for a specific period and should not be continued. I concede that certain preliminary measures were supposed to produce experience and, to some extent, did produce experience which must now be utilized by private initiatives. However, I caution against using relatively long term research subsidies, destined for medium-sized industries--or certain negative experiences made in connection with them--as an argument in favor of a full withdrawal from this area. Rather, I believe that it is necessary to maintain certain important subsidies, to remember what the situation was at the beginning, and to examine seriously whether--and to what extent--it can still be viewed in the same light; we can then react flexibly to possible changes or new understandings."

Cabinet minister Doctor Bechte of the Federal Ministry of Research and Technology declared that BMFT wanted to retain certain measures for the subsidy of innovation in small and medium-sized companies. Bechte declared that there are problems that tax credits alone cannot solve, citing as examples:
--cooperation between trade and industrial science;
--establishment of technology oriented companies.

Bechte doubted that the present subsidy levels could be maintained for small and medium-sized companies which, according to BMFT statistics, receive 16 Pfennigs of state subsidy for every DM they spend on R&D. However, like Cabinet minister Kohn, he hinted at alternative solutions.

It was certainly not merely a courteous gesture toward the host that without exception, all participants in the discussion were in favor of greater subsidies for cooperative research in industry.

During the AIF discussions, it became apparent that the federal government expects to see a considerable effect on the performance and innovation capabilities of middle range industries as a result of considerable

development of the "AIF" cooperation model, increased funds, and greater cooperation from the AIF research associations, including the transfer of results. A clear distinction was made between this system of subsidies and the notion of government grants.

The texts of the papers given during the 1987 meeting of the AIF are available from the Confederation of Industrial Research Associations.

8617
CSO: 3698/M027

FRAUNHOFER STUDY EXAMINES ADVANCED TECHNOLOGY FIELDS

Bonn TECHNOLOGIE NACHRICHTEN-PROGRAMM INFORMATIONEN in German No 406, 20 Aug 87 pp 1-15

[Text] 1. Summary

The competitive position of national economies that are well equipped in terms of labor force and with correspondingly high wage and salary levels depends, among other things, on the constant development and introduction of new technologies. It is often feared that technological gaps with respect to other countries may arise, with negative effects on the nation's ability to compete. For this reason it is helpful to have analytical systems at hand which allow an early prognosis of such gaps in technological development. These systems must be concerned with the comparative measurement and assessment of internationally achieved technological standards and economic positions.

Indicators represent a promising approach toward the analysis of these problems. Although economic indicators are well established, they allow only indirect observation of technological developments in industry. Patent statistics and bibliometric indicators have been introduced--particularly in Anglo-Saxon countries--and have proved to be useful. Although indicators which allow a direct quantitative evaluation of technological specifications have often been proposed, they have found hardly any application to date. Although some Japanese studies exist, international research is lagging behind in the field of technology oriented indicator systems. The technometric system introduced in this study is aimed at compensating for this shortage.

The term "technometrics" [Technometrie] is ambiguous. On the one hand, it was selected as an analogy to the terms "econometrics" and "bibliometrics" [Bibliometrie] and means "assessment of technology" [Messen der Technik]. On the other hand, it signifies a special measurement system in the mathematical sense which is introduced in this study.

Initially, a methodological approach was taken in the development of this system, that is, an attempt was made to examine how technological indicators could be defined, collected, and processed. From the very beginning the study was carried out in such a way that not only are the framework and methodology of the technology indicator system introduced but the system is also made operational and applied. The immediate application of a new system has the

disadvantage of a weak theoretical basis, but offers the advantage of learning through use.

In addition to developing the methodology, the primary aim of this study was to contribute to the forecasting of technological and business opportunities. Basically, early forecasting offers two possibilities: it can be used to identify new product and development ideas, thereby contributing to the best possible exploitation of all technical resources at a nation's disposal. Or it can aid the processing and sorting of the available information on opportunities for innovation and development proposals in such a way that [the] decision makers in government and private enterprise have access to facts and data about technological weaknesses and strengths and can use these for the purposes of comparison. The exact use made by interested parties of this type of forecasting must be defined, since it offers the most objective information possible regarding the current stage of development of selected technologies, but [offers] no decision criteria regarding research priorities. One could, for instance, give priority to an increase in the promotion of those research and technology sectors of the national economy which are already strong or, on the other hand, one could give priority to weaker sectors. When put in context by expert estimates and combined with economic indicators for foreign trade, technology indicators also provide a kind of "technology report."

Preliminary studies on technometric methodology are, surprisingly enough, less common in Anglo-Saxon countries than in Japan. In the FRG there is a series of proposals concerning technology indicators, but so far these have provided no results. Of the five--partly translated--Japanese studies, only one can be compared to the one introduced here. In this study, interviews were used to make a detailed survey of 43 representative product groups from all major industrial sectors to provide over 5,000 comparable random values for the year 1982. In addition to Japan, the United States, the FRG, and some other European countries are covered by the study. Due to the broad scope of the selection, this data record can be used as a basis for a macroeconomic estimate of technology in the test countries.

The method used in the Japanese study provides a representative technology indicator for overall national economies. However, it does not provide any conclusions for individual technological sectors.

A detailed approach--essential if an accurate forecasting is to be achieved--requires that the study be restricted to selected technology sectors or product groups. In this study the following sectors were examined individually:
--immobilized biocatalysts;
--medications produced on the basis of genetic engineering;
--solar cells and modules;
--laser beam sources;

--sensors;
--industrial robots.

2. Methods

Parameters and data on these sectors were collected by means of interviews with FRG, U.S., and Japanese experts (in all over 200 individuals, 150 of these from private enterprise). Surveys were first carried out in the FRG. They were completed in the first half of 1986. In the United States interviews took place in February, July, and September of 1986. In Japan they took place in July and August of 1986. Written information and exhibition material requested from the manufacturers were also included in the survey. In the case of sensors a product databank was used which, due to the wide range of products available in this case, proved to be indispensable as well as interesting in terms of methodology.

A technology-specific representation of the qualitative and subjective estimates resulting from the detailed interviews is given in this study. The specifications collected in the survey were converted to indicators by means of the technometric computation system.

Technometric indicators are value aggregates made up of various sample statistics for scientific-technical specifications of a production process or a product. The scientific-technical specification or parameter defines a characteristic of the product or the production process and can therefore be interchangeably verified. The parameters used and the priority given to them in the computation of aggregate values is based on individual or collective estimates with regard to optimum functioning of the product or the process and therefore cannot be objective. Even if no priorities are established within the parameters, this will not provide objectivity, because in this case it remains disputable whether a parameter was included or not.

The international comparison of national products and processes means that technological disparities within the national economy are ignored and therefore domestic competition is not considered. This restriction is logically necessary, as the various firms competing within a national economy can all profit from the same R&D know-how, the same work force, and the same research infrastructure. Therefore, disparities in domestic competition are no indication of a non-functioning R&D system. The highest technical standard among domestic firms is taken here as the national standard.

National indices can be classified hierarchically but cannot be expressed in the form of a cardinal scale of indicators. For this reason they must be measured in the mathematical sense. The measurement system is defined by simple rules of conversion and contains an ordinal classification of the initial values, insofar as no aggregation takes place. With the aid of the

measurement system arbitrary summations can be made. The emphasis is placed on parameters characterizing areas in which there are strong international disparities. The computation system is designed to give indicator values between 0 (lowest world standard) and 1 (highest world standard).

In addition to the technometric indicators, some relative indicators for foreign trade are introduced. The economic indicators for indirect evaluation of the changes in the technological structure are based on definitions which to some extent give rise to problems such as "technology intensive products." A series of rigid "high technology lists" exist which use diverging criteria, as well as flexible lists based on market share criteria with regard to threshold and developing countries. The most suitable seems to be the two-part list by the NIW [Lower Saxony Institute for Economic Research] which distinguishes between "high technology" (R&D expenditure higher than 8 percent of sales) and high-level consumer technology (R&D expenditure between 3 and 8 percent of sales). This list offers substantial advantages if a synoptic examination of economic indicators with technometric indicators is required. The definition of "international competitive position" also poses a problem. Various indicators are in use, each characterizing individual aspects of international trade in technology intensive products. The market share of the most important competing countries, the market share of non-OECD countries, the bilateral export surplus with regard to the most important countries as well as the overall export surplus, the standard price (unit price) of exports, and the RCA indicator (relative export surplus in proportion to the average for processed industrial goods) have all been used successfully as relative indicators.

Macroeconomic comparisons on the basis of technology lists are generally based on the Standard International Trade Classification (SITC). A closer inspection of selected technologies reveals that bilateral trade currents are computed on the basis of the highest disaggregation level of the FRG Product classification (WA).

3. Results

3.1 Detailed Results

In the case of immobilized biocatalysts (enzymes) the position of FRG products is relatively strong. The technology indicator shows that the FRG is slightly behind the United States and Japan. Alongside these countries, Denmark plays a decisive role. The FRG achieves particularly good catalyst characteristics. The process technology for production, immobilization, and downstream processing of the catalysts is good, although it does not quite reach the standard achieved in the United States and Denmark. Japan dominates in the application of the catalysts. FRG and U.S. firms fall slightly behind in this respect. Surprisingly, the GDR plays an important role here. Overall one can say that in the field of biocatalysts, the FRG policy for technological

development can be directed toward securing the strong position held, rather than to catching up on a deficit with respect to the leading industrial nations. A detailed assessment of possibilities for application and priorities for further development is contained in the report. It cannot be summarized.

From an international comparison in the field of genetically engineered pharmaceuticals it appears that the United States still has a definite lead over the FRG, which in turn is ahead of Japan although the necessary skills are mastered internationally. Although the American firms are obviously superior, the American lead concerning the market maturity of the products--a deciding factor for the commercial success of the products--is not so strong. The superior position of the United States is based rather on project oriented know-how, especially in the field of molecular biology. Large FRG pharmaceutical corporations are only slightly behind American companies with regard to the standard of product development. However, the relatively advanced market maturity of German products has often taken advantage of the American know-how in molecular biology. It is also surprising that the developments in genetic engineering in the FRG are to a great extent dominated by new companies which are at a considerable disadvantage with regard to their American competitors in terms of capital. The development of genetically engineered pharmaceuticals has only progressed in a few cases to the stage of market introduction, and therefore it is not yet possible to express this development in terms of economic indicators.

The comparison of technometric indicators for solar cells and modules shows that FRG products and technologies are lagging far behind the development levels in the United States and Japan. Japan has the best values, particularly in the field of polycrystal and amorphous silicon. The United States shows some strong points in the case of special processes. Only in the field of monocrystal silicon is the FRG almost level with its competitors. At present it cannot be foreseen whether German firms pushing for increased cooperation with the United States will be able to meet the challenge of Japanese firms in the growth sector of amorphous silicon. At present the FRG supplies countries with less advanced technologies, such as France, Switzerland, Britain. In addition to the technological gap between the FRG and the United States and Japan, Germany also suffers from a drastic foreign trade deficit with respect to Japan. As the amorphous photovoltaic market has far greater chances of growth than the market for crystalline solar generators, the German position will either stabilize or worsen. Although German firms have achieved high technological standards, the success of this technology depends on keeping the costs low in order to guarantee the commercial realization of technological know-how. It can be assumed that foreign competitors have improved their production technology and can still offer competitive prices because they receive domestic subsidies. The photovoltaic industry is subsidized extensively in all the test countries.

The technometric indicator for laser beam sources shows a clear superiority of technological standards in the United States. In the case of some types, Germany has achieved a technological standard which surpasses the American standards in some cases or is level with them. In other cases Germany is just slightly behind the United States. At present there is no trace of a general technological inferiority with respect to Japan. On the other hand it is apparent that a series of laser developments--whole ranges and technical subsections--could be improved. Both Germany and Japan are lagging far behind the United States in the fields of ion lasers (especially high power ion lasers) and neutral gas lasers. In the field of diode lasers for optical communication, Japanese and American specifications leave the German standards far behind. Compared to international standards, peak performance is achieved in Germany primarily in the field of exciplex lasers [Exciples-Lasern] and in the case of certain dye lasers. The Japanese still do not have a dye laser on the market. German standards are also good for lasers used in production and medicine. Some German firms have built excellent high power carbon dioxide lasers. Yag-laser technology in the FRG has suffered due to the qualitatively, and to some extent quantitatively, poor supply of laser crystals caused by the high number of lasers for military use produced in the United States. Japanese manufacturers have solved the problem by developing their own material, whereas the FRG manufacturers are still fully dependent on imports.

The state of the art for lasers is reflected in foreign trade statistics. While there is a German import surplus from the United States, German firms have achieved a high level of success on the Japanese market. Semiconductor diode lasers, however, represent an exception to this which could lead to a handicap in the optical communication sector.

A recovery on the part of Japanese laser technology could lead to a slump in the presently favorable foreign trade situation, particularly as Japanese manufacturers are striving to corner the large market segments while neglecting the smaller ones for the present. On the other hand, a technological recovery in the United States could open up corresponding market segments (for example, by import substitution with German equipment).

The quantitative technometric assessment for sensors shows that the highest standards are indisputably held by U.S. sensor technology. This applies to both traditional and miniaturized technology. FRG sensor technology maintains a strong position with respect to the somewhat lower level of the Japanese technology. FRG microsensors, however, show a deficit compared to the United States and Japan. This applies particularly to sensors suitable for assessing chemical, biochemical, and material values. FRG firms maintain a strong position in the field of traditional chemical-analysis processes, so that the changeover to miniaturization is obviously difficult. German firms, however, have achieved commercial successes on the international market with their high technological standards in the field of conventional production processes and

particularly in the mechanical engineering sector. Only with respect to the United States, where there is a technological stalemate, has it been impossible to achieve similar successes. The foreign trade balance with Japan, judged on the basis of the average trade level, can also be regarded as a technological and commercial success.

However the trend seems to indicate some risk with regard to technological standards for sensors and the sensor market. The present favorable position in technology and marketing must be defended--wherever possible--by decisive steps in the direction of miniaturized sensors. The wide range of opportunities for technological improvement and new lines of development cannot be summarized here. A more detailed analysis can be found in the main section of the report.

The technometric indicator for industrial robots shows that the FRG maintains a strong position with regard to the mechanics of robot technology. German equipment has an advantage here based on solid mechanical engineering know-how. American equipment, particularly in the case of precision parameters, falls somewhat short of the German standards. This is not true to the same extent in the case of Japanese equipment. The high mechanical quality of German equipment is particularly apparent in the field of spot welding. The FRG shows a deficit in the field of robot controls. American equipment has a lead in all applications where control is particularly important (continuous-path welding, assembly). Technological developments for the future and improvement possibilities are dealt with in the main section of the report as they cannot be summarized here.

The high level of the FRG robot technology is reflected by commercial success on the world market. German manufacturers can assert themselves technologically and commercially, particularly in competition with Japan and the United States. On the high-tech level, however, there is a technological stalemate in the field of continuous-path welding robots: all the test countries including Sweden have equally high specifications. Slumps in foreign trade would most certainly result if the FRG fails to maintain its peak position. The good technological position held by the assembly robot sector--particularly in the medium load range--seems to be a guarantee that future successes on the international market can be achieved. This favorable position with respect to the two main competitors has only been achieved since the beginning of the 1980's.

From the six selected technologies it appears that in the field of research intensive product groups the average FRG specifications are superior to the Japanese and inferior to American specifications. The order of precedence in heavily research intensive sectors such as laser technology indicates that FRG firms have so far been able to defend their position as second in the world. The reason for this is the existence of a differentiated, traditional scientific research activity which is independent of industry. Such a system

also exists in the United States but is not found on such a large scale in Japan. However, Japanese firms still manage to achieve remarkable successes in the field of mass production technology. The limited resources in Japanese non-industrial research, however, leads to deficits. The technological standards in the six selected sectors show a greater level of scattering in Japan than in the United States and the FRG.

Strengths and weaknesses for the selected sectors are distributed at opposite ends of the scale in the United States and Japan. The two particularly research intensive sectors, laser technology and genetic engineering, are stronger in the United States than the other sectors included in the study. However, in Japan, they fall behind robot technology which is not so directly dependent on the latest successes in research. Even in the synopsis the selected sectors are not representative enough for a macroeconomic comparison. One must resort here to a representative Japanese data record for 1982. A re-evaluation of this data record shows a dominant position for Japanese industrial technology (consumer technology and high level consumer technology) and a dominant position in U.S. high technology. Therefore, it is apparent that the strengths of Japanese and American firms are at opposite ends of the scale. American technology dominates in the research intensive sectors while Japan is stronger in product sectors with medium or low research expenditure. FRG technological standards are well balanced and high compared to these two countries. This means that FRG standards are higher than the Japanese in research intensive high technology sectors, and are higher than American standards in the other consumer technology sectors. The economic RCA indicator corresponds to the technology indicators. In each case the FRG maintains a middle position between Japan and the United States with regard to international trade. This result may surprise those who attach little importance to the level of technological development as a measure for success in international trade, looking for explanations in areas such as protectionism and international exchange rates.

The technometric method used in this study has proved itself in a number of ways. In the interpretation of the results, however, one must not forget the limits of the approach, the problems involved in selecting parameters, and the availability of data, which is somewhat restricted. To a certain extent, the combination of interviews with experts with the formula numerical values of technometrics implies the necessity of quantitative representation, while at the same time guarding against the risk of misinterpretation due for instance to misunderstandings. In the subjective experience of the observers, the numerical values of technometrics allow a more open and concentrated discussion than interviews which are not aimed at a quantitative representation of the individual estimates.

All in all, the authors of the study regard the addition of the formal framework to the survey of technological standards in sensitive areas of high

technology as an aid which not only has no negative effects on readily available qualitative and subjective estimates, but which also serves to place them in a realistic and relevant perspective.

4. Overall Results

4.1 Technology Indicators and Macroeconomic Indicators

Figure 4.1 shows the indicator values for those 11 product groups for which the indicator value for the FRG is the highest (K^* greater than 0.7). One must be careful however, not to over-interpret the results. The individual product groups represented are fairly nonhomogenous. The technological parameters for nuclear reactors, for instance, are composed of data for pressurized water reactors and boiling water reactors. The higher indicator value is for Japanese reactors; this is remarkable given that Japan cannot compare with the FRG in terms of export success, and can only be explained by the fact that Japan's boiling water reactors are superior to those in the FRG. It was necessary to combine various technologies in the Japanese study in order to cover different industrial sectors with a justifiable level of effort. This compounding of different technical products, however, is unsatisfactory for an adequate technological representation. For this reason, complete coverage of the industry classification is not attempted by the ISI survey, but rather a finer differentiation of the preselected technological sectors.

Figure 4.2 gives the technometric indicators for those 13 products for which the FRG has values of less than 0.7. Normal steel [production] has the lowest values. We have serious doubts, however, about the accuracy of this result. Most of the individual data for the FRG--as opposed to the Japanese and the U.S. data--are not scattered (maximum value per parameter = minimum value). The sample taken for FRG steel production must therefore have been unreasonably low and not representative of the best plants. On the other hand, the technometric result is not incorrect in the indication that the European steel industry is presently experiencing a crisis, including a crisis in the technology field. The "Medium Term Guidelines for Steel Industry Research (1986-90)" drawn up by the European Community confirm this estimate with the statement that the two major objectives for joint research in the steel sector are "an increased and improved uniformity of quality in its various aspects "(KOM(85) 392 final).

However, a further example may serve as a warning against over-interpretation. The superior performance of Japan in the polyester fiber sector (Figure 4.2, center) could well be due to the time of the survey. Crisis industries legislation in Japan in 1978 was responsible for production limits based on plant capacity utilization in the synthetic fibers industry. This could have accelerated technological progress for this type of plant, thereby providing a particularly favorable picture at the time of the survey in 1982.

Figure 4.3 shows the technometric indicators for those product groups for which a comparison was made with a Western European country other than the FRG or in cases where technological cooperation in Europe prevents a scattering of values for national standards (for example, aircraft, information satellites, and video recorders). Figure 4.4 gives indicators for those product groups for which a comparison could only be made between Japan and the United States, because of a lack of data for Europe.

If the values for the 43 product groups are aggregated to provide an overall national standard, the national technometric indicators are as follows:
--0.81 for Japan;
--0.77 for the United States;
--0.67 for the FRG;
--0.69 for Western Europe.

As there is a broad scope for error, it is difficult to determine whether these indicator values show a significant difference. A possible lack of representation in the high-tech sector, incompletely compounded parameters, inaccurate indices and various other factors must be taken into account. A calculation of error for these factors is not possible. However, this drawback is not peculiar to technology indicators; since the same applies to other indicators. Nonetheless, it is desirable to be able to determine which differences are significant and which can be regarded as unimportant.

We are in a position to set a lower error limit, below which differences in the indicator value are completely insignificant. The numerical values used are rounded off and are therefore subject to the rule of significance. If the rounding-off of the original data is regarded as the only source of error and, in accordance with the error compensation method, the indicator values are rounded up, the result is that the lower error limit for the value aggregate for national standards is approximately 0.02. The indicator values for Japan and the United States can, within the lowest margin of error, be regarded as equal, while the European countries fall slightly behind. Nonetheless, the leading nations are a long way from holding a generally superior position in all technology sectors--this would provide an indicator value of 1.0. The values for the Western European countries lie well within the upper half of the numerical interval between 0 and 1 that represents the range of technological standards in the test countries. All the values given reflect a static estimate for the year of the survey, 1982.

Two possible methods were used to arrive at statements regarding the dynamic position of the countries with the aid of technology indicators:
--a differentiated analysis of "old" and "new" products;
--a demarcation and examination of all key technologies using all parameters of the data record.

The 43 product groups of the JATES/AIST study were divided by a subsequent

publication (Agentur 1983) into growth products and perfected products, in accordance with the product cycle principle. If one accepts this division, thus halving the data record, and aggregates all technological parameters individually in order to compare them, one arrives at an estimate for the dynamic position of each country, insofar as the technological standards for the new products in the growth sectors will be more important in the future than those of the perfected product groups. The relationships between the indicator values for new and old products are as follows:

--for Japan	0.76 : 0.87 = 0.88
--for the United States	0.90 : 0.69 = 1.29
--for the FRG	0.67 : 0.69 = 1.00
--for Western Europe as a whole	0.71 : 0.67 = 1.06

Due to the rounding of the initial data, the results contain an error margin of at least 3 percent. This shows the strong dynamic position of new products in the United States compared to other countries (0.90) and related to fully developed American products (1.29). The favorable balance in Europe between new and perfected products is accentuated by the fact that in the case of new technologies there is hardly any significant difference to Japan (0.71 - 0.76). According to the 1982 data, Japan in fact achieved the best results in the adoption of established technologies from abroad (0.87 to 0.76).

The second method of arriving at a dynamic estimate of the technological standards consists in demarcating the so-called key technologies under all parameters and considering them individually. It is hardly possible to classify all of the parameters--totaling almost 1,000--as significant for either a key technology or a standard technology. However, experience shows that in the majority of cases such a classification can be made. The authors of the JATES/AIST study had asked the participants to identify any such key parameters (JATES 1985). We have examined this classification and found it satisfactory.

If all the data is now aggregated into the categories "standard parameters" and "key parameters," and these are related to each other, a further estimate of the dynamic position of the countries can be obtained.. A higher technological standard in the case of key technologies encourages the hope that a positive change will take place in the course of time. The individual results are as follows:

--for Japan	0.81 : 0.83 = 0.97
--for the United States	0.84 : 0.68 = 1.23
--for the FRG	0.71 : 0.58 = 1.22
--for Western Europe	0.74 : 0.60 = 1.23

The lower error limit for the minimum rounding off errors is again 3 percent. The above estimate based on the product cycle principle is confirmed for Japan and the United States. The United States maintains a significantly higher position in key technologies than in standard technologies. It is surprising,

however, that Europe also has better values for the key technologies than for the standard ones. Since 1982 this fact has been an incentive for improvements in the technological sector. The differential technometric values based on product cycles and key technologies are shown in Figure 4.5.

Thanks to its representative coverage of technology intensive production, the Japanese data record can be used in the form of a screen study to detect the nature of parameters in presupposed technology patterns. As represented in table 4.1, we set up a screen which, of all the parameters, filters out those in the areas of resource intensity, environment intensity, construction technology, precision mechanics, and computer aided manufacturing. All parameters taken in the sample can be allocated to this screen. By aggregating only the corresponding parameters in each case right through all product groups, one obtains the technometric indicators shown in Table 4.1.

When the minimum degree of error caused by rounding off is taken into account, indications of improvements are found primarily in the fields of noise reduction and exhaust technology. There are also indications of improvements in the fields of energy exploitation, industrial production, and precision mechanics. The individual parameters provided by the screen study are illustrated in Tables 4.2 and 4.3 using the examples of exhaust technology and noise reduction technology.

A variable application of the technometric system in different sectors and stages of aggregation can be demonstrated with the aid of the Japanese data record. It was possible to set up a series of technology indicators on the national, technological, and dynamic levels. However, it also became apparent that the representative coverage of the whole area of technology intensive products means that there are quite heterogenous products right behind the product groups examined.

How do the estimates based on technological indicators look against the background of international trade? If the parameters from the Japanese data record are aggregated on the basis of the NIW technology list (Grupp, Legler 1987) under "High Technology," that is, product groups for which R&D expenditure exceeds 8 percent of sales, under "high level consumer technology," or product groups for which R&D expenditure lies between 3 and 8 percent of sales, and under "other consumer technologies," for which R&D expenditure is less than 3 percent), the result is the technometric indicators in Figure 4.5. It is apparent that the U.S. and Japanese technologies have their strong points at opposite ends of the scale. American technology dominates in research intensive sectors while Japanese technology is particularly strong in product areas with medium or low research expenditure (such as videorecorders, ships, steel, and desulphuring plants). Compared to these two countries, FRG standards are well balanced and high, leading one to conclude that in research-intensive high technology, FRG standards are superior to those of the Japanese, and are superior to U.S. standards in the

other consumer technologies.

The technology indicators shown in Figure 4.6, grouped according to R&D intensity, can now easily be compared to the correspondingly grouped foreign trade indicators. Figure 4.7 compares the technometric and RCA indicators for 1982 (the RCA indicators were computed in another study--see Grupp, Legler 1987). The classification of technological and economic indicators corresponds exactly. The FRG holds the central (medium) position in each case. The same applies to the classification of the two indicators for high level consumer technologies. However in this case, the difference in the technological indicators for the FRG and the United States is not very marked (differences within the range of rounding-off errors are not significant).

The result may surprise those who attach little importance to the level of technological development as a measurement of success in international trade, looking for explanations such as protectionism and international exchange rates. However, insofar as our data is representative, and given all the limitations of the technometric model, the RCA system, and the technology lists it contains, we can only conclude that the level of technological development is reflected by international trade success. The "technology" factor and the proceeds of applied research and development seem to play a very important role in terms of success in foreign trade.

4.2 Technometric Indicators for Selected Technology Sectors

Figure 4.8 shows the aggregated technometric indicator values for the selected technologies in the United States. The sectors are arranged in order of descending value from left to right. The high level of U.S. technology in all the selected sectors is evident at a glance. Peak values are obtained in the fields of genetically engineered pharmaceuticals on the basis of genetic engineering and laser technology, both areas which depend to a particularly large extent on science and research. All the selected technologies belong to strongly research-intensive sectors, in which the even greater dependence of laser technology on physics research, and genetic engineering on biochemistry, remains incontrovertible. The opinion that the leading position of the United States in research-intensive areas is even more apparent in sectors where firms are most dependent on nonindustrial research centers--expressed so often that it has become a cliche--seems to apply to the results of our quantitative survey as well.

Almost the exact opposite is true of Japan. A corresponding arrangement of the indicator values for the selected sectors in Figure 4.9 shows that development in Japan is lagging behind in those areas where U.S. firms maintain higher than average positions. Relative deficits in the laser and genetic engineering sectors are due to the lack of development in Japanese universities and university related research institutes. Japanese development is strong in areas where a rapid and complex transfer of information acquired

from science and research is less important than the organized application of industrial know-how. Therefore it is not surprising that of the selected sectors, Japanese robot technology occupies the leading position.

Next to enzymes, Japan--a country poor in raw materials for generating of energy--is particularly strong in modern energy technologies. However the desire for a reduction in the [country's] dependence on imported energy is not the only reason for its highly developed photovoltaic technology. The other reason is its well developed silicon technology. In the case of Japan, the high standards in enzyme technology seem to be not so much the result of the intensive application of university research, but rather of the traditional Japanese strength in the field of nutritional technology (see section 3).

The example provided of the strengths and weaknesses in FRG technology does not allow a comparison with either Japan or the United States. On the one hand, industrial robot technology is highly developed--as in Japan--and on the other hand, there is a highly developed scientific laser technology--as in the United States. Genetic engineering, which is particularly dependent on research--contrary to the situation in the United States--lags somewhat behind, as does photovoltaic technology, although this sector has been promoted by the government for a relatively long time.

The fact that West Germany--unlike Japan but similar to the United States--has a long tradition of research and technology with a differentiated and wide range of research facilities, seems to have a positive effect on the extensive development of modern technology. In the FRG, the technological disparities in the selected sectors--as in the United States--are in close proximity (see Figures 4.8 and 4.10). In Japan, however, they are more widely distributed. The respective peak values in the FRG and in Japan are slightly under 0.8 for robot technology, while the lowest value for Japan is substantially lower than [the corresponding value] in the FRG. Despite all efforts to bring Japanese technology up to international standards, it has obviously not been possible to achieve this in all sectors. Limited scientific capabilities have led to a concentration on certain technologies (such as automobiles, videorecorders, and hi-fi) has necessarily led to technology gaps. On the other hand, technology in the FRG and the United States is known for the relative equilibrium of technological standards in the selected sectors which are quite heterogenous.

Figures 4.8-4.10 indicate relative strengths and weaknesses in the three test countries. The conclusions for future activity in industrial research and development in the FRG cannot be drawn here. This study is more concerned with nonscientific criteria and political assessments or targets concerning industrial structures and international trade strategies. Insofar as the major criterion of technological policy is increasing the promotion of those sectors in which the national economy is currently strong, we consider that robot technology should be given precedence over solar technology. However,

if technology policy is concerned with strengthening deficit areas, then photovoltaic technology must be given priority. The same applies to the test countries. Technometrics as a method of forecasting--as demonstrated here--can supply facts and data regarding strengths and weaknesses, but no decision criteria. All in all, the technological disparities in West Germany--at least in the case of the six sectors examined--are not very great, so that on this level of aggregation there is no strong quantiative argument in favor of any particular technology.

The six technology sectors selected are not representative of so-called high technology (however, it may be specified in individual cases). However, they are all research intensive sectors and are therefore certainly covered by the generic term "high technology." The macroeconomic analysis (see section 3) showed that FRG standards in high technology are above those of Japan and consequently take second place after the U.S. standards. The opposite applies in the category of less research intensive "high level consumer technology" where Japanese standards are higher than FRG standards. This is confirmed in the sectors examined here. On average, the technology indicators in Figure 4.8 are the highest, those in Figure 4.10 take second place, and those in Figure 4.8 are the lowest. This is the result of the calculation of the mean values for the six technology sectors, giving an overall technology indicator of:

--0.79 for American standards
--0.66 for West German standards;
--0.62 for Japanese standards.

Our detailed quantitative survey, which does not contradict expert qualitative estimates, proves beyond a doubt that in the case of research-intensive technology FRG firms are ahead of Japanese firms but behind U.S. ones. This is in line with the traditional pattern for the international division of labor in research and technology, a pattern that remains unshaken. The often voiced claim that Japan has overtaken the FRG in technology usually cannot be quantified. This claim may very well be true of technologies that play a role in mass production. Research intensive technology sectors, however, require a broad, well established, nonindustrial, scientific infrastructure, and this does not exist in Japan. It is presently being built up with a great deal of effort. (Kodama 1987), but as yet (1986) has had no effect on technological standards.

According to our analysis, the frequently mentioned gap between FRG high technology and that of the United States and Japan is irrelevant. One should also take into account that almost all indicator values for the six technologies in the three countries are above 0.5, or in other words, above average (for method of measurement, and significance of the indicator values, see section 2.2). This leads to the conclusion that in certain sectors (with certain indices) including those which show a deficit, peak values are achieved and lead to an above-average value indicator.

An evaluation of trends in the classification of the three countries in high technology cannot be done here. The technology indicators were collected at different times during 1986, and a time frame is not available. Nor is it possible to compare our indicators with those of the 1982 Japanese study because different technologies were selected in each case. However, the classification remained the same between 1982 and 1986. In the case of high technology, U.S. technology was ahead of the FRG's, and FRG technology was ahead of the Japanese in both years (see above and Figure 4.6). Although the technologies examined cannot be compared, it may be concluded that the technological position of the FRG in the high tech sector has not suffered since 1982 with respect to Japan, and that it has improved with respect to the United States. Due to the long term nature of the effects of changes in the R&D system, this should not be regarded as a firm reassurance for the future.

Given that there is a different correspondence between each technological sector and economic categories for foreign trade, it is not possible to give a quantitative synopsis in this respect. Table 4.4 therefore providesa comparison. The technology sectors examined are shown in the table in order of decreasing technology indicator values, and the foreign trade results, evaluated with "+" and "-," are compared bilaterally with the United States and Japan for the year 1985 or the first half of 1986. The product groups selected were those which correspond most closely with the respective technological sector. Table 4.4 shows that the foreign trade values are directly proportional to the technology indicator values. In general, they are lower with respect to the United States (which corresponds to the technological position) than with respect to Japan. Technological and economic indicators do not entirely correspond to each other. However the trend is toward a favorable correspondence of technological standards to international commercial success, as was the case for the macroeconomic indicators (see section 3). Therefore we repeat that insofar as our survey is accurate, and given all the restrictions of both the technometric and the econometric systems, the level of technological development is reflected in international commercial success. The "technology" factor and the proceeds of applied research and development seem to play a very important role in in foreign trade success.

The quantitative part of the study must be restricted to products that have been on the market for at least a short period of time. Although it is possible to formulate technometric indicators for products and processes which are still in the prototype stage, or which are almost ready for market introduction (for example, genetic engineering), they cannot be compared with economic values, and therefore a synopsis of technological and economic indicators is not possible.

Apart from this, the results for the six selected technologies show that the technometric system has proven effective. While the Japanese data record provided only formalized comparisons that are difficult to analyze, the

technology indicators for the sectors selected in this study have a deeper significance. As early as the interview stage, they serve to introduce anonymous data from other experts thereby drawing attention to areas which may be important, controversial, or undecided. The combination of expert interviews with the formal numerical values of technometrics suggests the necessity of quantitative representation, while simultaneously guarding against the risk of misinterpretation caused for instance by misunderstandings. In the subjective experience of the observers, the numerical values of technometrics allow a more open and focused discussion than interviews that are not aimed at quantitative representations.

The smaller the number of values, the more difficult it is to guarantee confidentiality. Therefore it is particularly advantageous, if one intends to achieve detailed technological parameters, to operate with a wide range of anonymous firms and national technology profiles and standards. The issues raised by normal consumer surveys have no relevance for the technometric system and therefore cannot falsify data or complicate the collecting of data. This is an important difference from product tests in which the technical data presented is connected directly with the product concerned.

Overall, we regard the addition of the formal framework to the survey of technological standards in sensitive areas of modern research and development as an aid which not only has no negative effects on readily available qualitative and subjective estimates, but which also serves to place these in a realistic and relevant perspective.

The trend toward statements on the efficiency of research and development which has led to a constant improvement in bibliometric indicators, patent statistics, data on research budgets, as well as to the constant improvement in econometric methods and indicators, has left a gap in the field of comparative, direct, and quantitative estimates on technology. The methods and conventions for the collection and representation of technology indicators lag far behind the normal standards for all other research, development, and innovation indicators.. Hopefully this project will allow the development and application of technology indicators to the extent that they can be considered for application within other quantitative data concerning the efficiency of research and development. At the end of this project, it is left to the reader to assess whether this expectation has been at least partially fulfilled. hope of developing and applying technology indicators to the extent that they become worthy of consideration for application in the context of other quantitative data on the efficiency of research and development. On conclusion of this project, it is left to the reader to decide whether this hope has been at least partially fulfilled.

5. Forecasting Technological Developments on the Basis of Patent Data

The BMFT has commissioned a number of projects aimed at forecasting marketable technological developments. One possibility here is to refer to information provided by the patent system. The application for a patent always suggests there is a claim to have made a new technical development. A number of years usually pass between the application for a patent and introduction [of a product] to the market. Patent information can therefore serve as a means of forecasting.

The aim of the IFO [Institute for Economic Research] research project was to examine the indications for future developments in technology that can be gained from a statistical analysis of inventions. The study covered the whole spectrum of technology--with reference to the proposed systematic study of the forecasting value of patent data--divided into different technology sectors in which the number of inventions has recently shown a strong increase internationally. This criterion is based on the innovation theory that technological breakthroughs are followed by a flood of inventions. Although this approach seems simple, the empirical application is complicated.

Technology sectors can only be identified by reference to the traditional areas of specialization. When one considers the interrealtions between the various areas of specialization, it is clear that new areas can often arise within the traditional areas. Therefore concentrating on the "old" patent classification does not provide indications concerning the nature of new technologies.

The search for promising technology sectors for the future requires the development of a special assessment method (cluster program system) to clearly define international invention activity in 60,000 specialized areas.

Those technological areas for which the rate of change in product development activity is above an estimable curve are filtered out. On the basis of patents that are classified for a number of specialized areas, it is possible to group specialized areas from various sectors as technology sectors.

With variable cut off values for all technology sectors, this program was applied to state of the art technology to identify 155 promising future technology sectors. The relevance of these sectors requires more detailed analysis and this can be done through discussion of the results with experts from the respective areas.

The promising future technology sectors, which accounted for 10 percent of patents in more than one country, can be classified roughly as shown in Figure 5. A separate study deals with the 155 sectors individually.

The analysis of the position of the most important industrial countries in

technology sectors with a high level of product development showed a differentiated overall picture. Although FRG firms maintain a relatively strong position in a whole series of technology sectors, the overall view of the sectors shows higher than average strength for both U.S. and Japanese research. The FRG occupies third place, well ahead of all other industrial countries. If this data is put in relation to the GNP of the respective countries, the FRG and Japan share first place, ahead of the United States. Development in state of the art technology shows that German research has the greatest influence in promising technologies for the future.

The fact that there is a wide range of German research with a relatively low level of concentration in any specific area clearly indicates that the FRG can successfully adapt to new trends.

The fact that this study may have some faults does not detract from its value as the first systematic test of the estimate of patent statistics related to technological development. Comprehensive details will only be available only after some years.

Even if the first practical application were to achieve a high level of accuracy, the problem of "picking the winners" is by no means solved. Information gained from patent statistics could suggest a beginning or an extension of research. However it can also act as a warning against becoming involved in a senseless technological race. A more detailed analysis of the situation remains in the hands of the decision makers in government and private enterprise.

1 Tabelle 4.1: Rasterfahndung nach vorvermuteten Technologiemustern im japanischen Datensatz (Quelle: ISI, JATES/AIST)

2 Technologiemuster	3 Technometrischer Indikatorwert K* USA	J	BRD	4 Fehleruntergrenze	5 Prod.-untergruppen	6 Kenngrößen	7 Datenmenge
8 Ressourcenintensität	0,65	0,83	0,71	7 %	16	34	204
. Nichtenergetische Ress. 9	0,61	0,77	0,69	10 %	11	15	90
10 . Energieintensität	0,60	0,89	0,71	10 %	14	19	114
Umweltintensität 11	0,60	0,89	0,67	8 %	10	20	168
12 . Lärmbelastung	0,54	1,00	$\boxed{0,45}$	15 %	5	8	42
. Ableitungen 13	0,72	0,86	0,73	9 %	9	21	126
14 .. Flüssiger Aggregatzustand	0,78	1,00	0,90	15 %	5	6	40
.. Gasförmiger Aggregatzustand 15	0,69	0,77	$\boxed{0,55}$	11 %	7	13	78
16 Konstruktionstechnologie	1,00	0,87	0,83	8 %	12	26	168
. Numerische Techniken (NC-Module) 17	1,00	0,91	0,82	11 %	12	14	84
18 . Computerunterstützung (CAD)	1,00	0,82	0,81	11 %	12	14	84
Präzisionsmechanik (µ-Mechanik) 19	0,77	0,87	0,70	12 %	5	11	66
20 Computerunterstützte Produktion (inkl. CAM)	0,90	0,71	0,78	11 %	5	13	70

21 [ ] = Rückstand in der BRD zu beiden Konkurrenten außerhalb der Fehleruntergrenze

22 [ ] = Rückstand in der BRD zu einem Konkurrenten außerhalb der doppelten Fehleruntergrenze

1. Table 4.1: Screen study according to estimated technology patterns in the Japanese data record (source: ISI, JATES/AIST)
2. Technology pattern
3. Technometric indicator value K*
4. Lower error limit
5. Product subsections
6. Parameters
7. Volume of data
8. Resource intensity
9. Non-energy resources
10. Energy intensity
11. Environment intensity
12. Level of noise disturbance
13. Waste disposal
14. Liquid form
15. Gas form
16. Design technology
17. Numerical technologies (N/C modules)
18. Computer aids (CAD)
19. Precision mechanics
20. Computer aided production (incl. CAM)
21. FRG behind both competitors outside of the lower error limit
22. FRG behind one competitor outside of the doubled lower error limit

Tabelle 4.2: Rasterfahndung nach vorvermuteten Technologiemustern am Beispiel der Ablufttechnik (Quelle: ISI, JATES/AIST) 1

2 Produktgruppe	3 Kenngröße	4 Maß	5 Technometrie-Indikator K* US	J	BRD	6 Datei-Nummer
7 PVC	8 Gasförmige Leckagen	rel	1,00	1,00	0,00	109-07
Zement 9	NO_x-Abgas 10	ppm	1,00	1,00	0,50	[illegible]
"	11 Staub im Abgas	mg/Nm³	0,00	1,00	0,00	121-07
"	Staubabscheider 12	St/Fab.	0,00	1,00	0,00	122-10
13 Gasturbinen	14 NO_x-Ausstoß	ppm	0,54	1,00	0,30	143-09
"	Abwärme an die Luft 28	rel	1,00	0,60	0,60	145-05
15 Abgasentschwefelung	16 Entschwefelungsgrad	%	0,77	1,00	0,77	154-01
Pkw	Motordrehmoment pro Abgas 18	kpm/l	0,75	0,81	1,00	187-01
" 17	19 Motorleistung pro Abgas	PS/l	0,12	0,61	1,00	187-02
20 Zivilflugzeug	NO_x-Ausstoß 21	g/km	1,00	0,00	1,00	192-07
"	22 SO_x-Ausstoß	rel	1,00	0,00	0,17	192-08
23 Kernreaktor	Edelgasemission 24	Ci/a	0,84	1,00	0,92	200-06
"	25 Jod-137-Emission	mCi/a	0,99	1,00	0,85	200-07
26 Summe	Ablufttechnik 27	K*	0,69	0,77	0,55	

1. Table 4.2: Screen study according to estimated technology patterns with exhaust technology as an example (source: ISI, JATES/AIST)
2. Product group
3. Parameter
4. Unit
5. Technometric indicator K*
6. Data #
7. PVC
8. Leakage of gas
9. Cement
10. NO_x exhaust
11. Dust in exhaust gas
12. Dust separator
13. Gas tubrines
14. NO_x exhaust
15. Desulfurization of exhaust gas
16. Degree of desulfurization
17. Automobiles
18. Motor torque/exhaust gas
19. Engine output/exhaust gas
20. Civilian aircraft
21. NO_x exhaust
22. SO_x exhaust
23. Nuclear reactors
24. Emission of inert gases
25. Emission of iodine 137
26. Total
27. Exhaust technology
28. Heat released into the air

Tabelle 4.3: Rasterfahndung nach vorvermuteten Technologiemustern am Beispiel
1 der Lärmschutztechnik (Quelle: ISI, JATES/AIST)

2 Produktgruppe	3 Kenngröße	4 Maß	5 Technometrie-Indikator K* US	J	BRD	6 Datei-Nummer
7 Zement	8 Lärmbelastung vor Ort	dB	1,00	1,00	0,00	121-08
9 Baumaschinen	10 Lärm am Gerät	dB(a)	0,33	1,00	0,56	146-08
11 Baumaschinen	12 Umgebungslärm	dB(a)	0,30	1,00	0,50	147-09
13 Höchstspannungstrafo	Lärmbelastung 14	dB	0,00	1,00	0,00	162-05
15 PKW	16 Lärmbelastung Umgebung	rel	1,00	1,00	1,00	185-11
17 PKW	18 Lärmbelastung im Fahrzeug	dB(a)	0,50	1,00	0,00	185-11
19 Zivilflugzeug	20 Lärmbelastung beim Start	Phon	0,66	1,00	0,90	192-09
21 Summe	22 Lärmschutztechnik	K*	0,54	1,00	0,42	

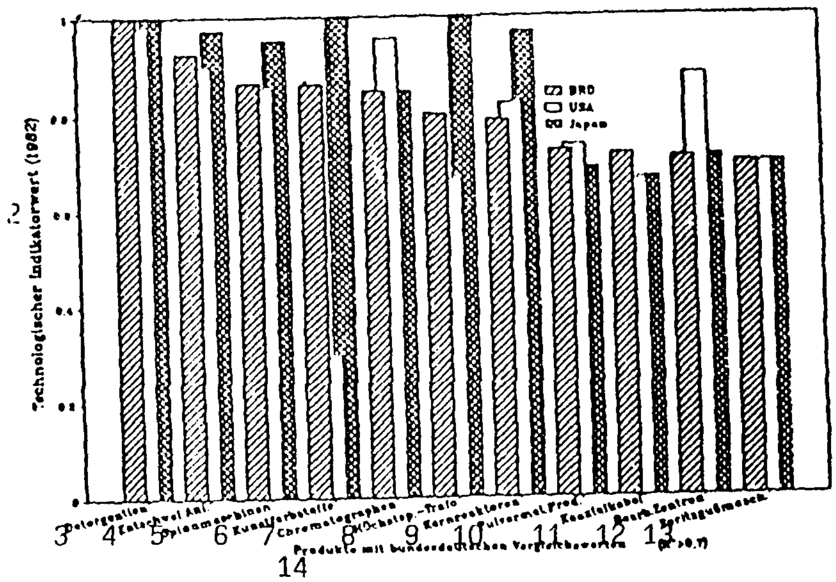
1. Table 4.3: Screen study according to estimated technology patterns with noise reduction technology as an example 4(source: ISI, JATES/AIST)
2. Product group
3. Parameter
4. Unit
5. Technometric indicator K*
6. Data #
7. Cement
8. Noise level on the site
9. Construction machinery
10. Noise level at the machine
11. Construction machinery
12. Environmental noise
13. High voltage transformers
14. Noise levels
15. Automobiles
16. Environmental noise level
17. Automobiles
18. Noise level in the automobile
19. Civilian aircraft
20. Noise levels on takeoff
21. Total
22. Noise reduction technology

1 Tabelle 4.4: Rangskalierte Gegenüberstellung technischer und ökonomischer Indikatoren für die ausgewählten Technikgebiete (bezogen auf die Bundesrepublik)

2 Technikgebiet	3 Technometrischer Indikatorwert	4 Außenhandelsindikator (RCA bilateral gegenüber USA)	5 Außenhandelsindikator (RCA bilateral gegenüber Japan)
6 Industrieroboter	0,78	+/-	++
7 Laserstrahlquellen	0,71	-	+
8 Biokatalysatoren	0,65	+/-	+/-
9 Sensoren	0,63	-	+
10 Gentechnische Humantherapeutika	0,60	12 k.A.	k.A.
11 Solarzellen	0,53	--	--

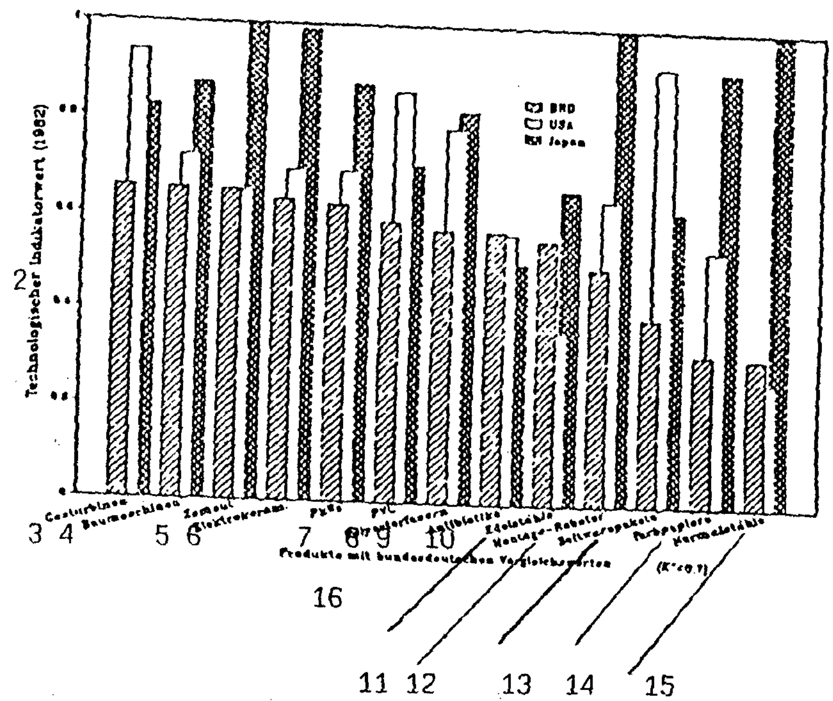
1. Table 4.4: Scale comparison of technological and economic indicators for the selected technological sectors (with reference to FRG)
2. Technology sector
3. Technology indicator value
4. Foreign trade indicator (RCA bilateral vs. the United States)
5. Foreign trade indicator (RCA bilateral vs. Japan)
6. Industrial robots
7. Laser sources
8. Biocatalysts
9. Sensors
10. Genetically engineered pharmaceuticals
11. Solar cells
12. No foreign trade

1 Abb. 4.1: Technometrische Indikatorwerte von 11 technologieintensiven Produk-ten mit den höchsten Werten für die Bundesrepublik (Quelle: JATES/AIST, ISI)



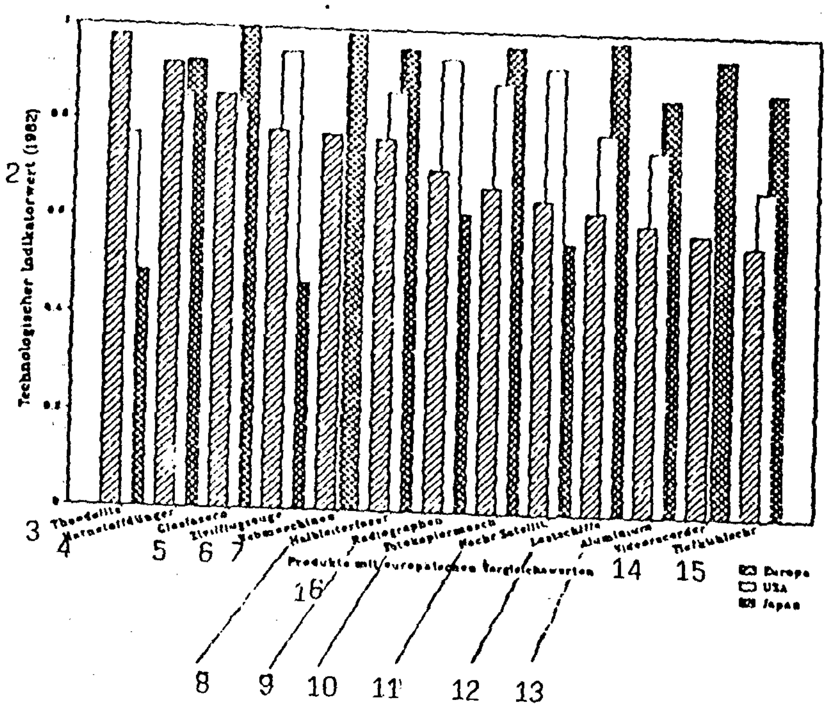
1. Figure 4.1: Technometric indicator values for 11 technology intensive products with the highest values for the FRG. (source: JATES/AIST, ISI)
2. Technology indicator values (1982)
3. Detergents
4. Plants for desulfurization
5. Spinning machines
6. Synthetic dyes
7. Chromatography
8. High voltage transformers
9. Nuclear reactors
10. Powder metallurgy products
11. Coaxial cables
12. Machining centers
13. Injection molding plants
14. Products with comparative values for the FRG

Abb. 4.2: Technometrische Indikatorwerte der 13 technologieintensiven Pro-
1 du[illegible]gruppen mit niedrigen Werten für die Bundesrepublik (Quelle: J[illegible]IST, ISI)



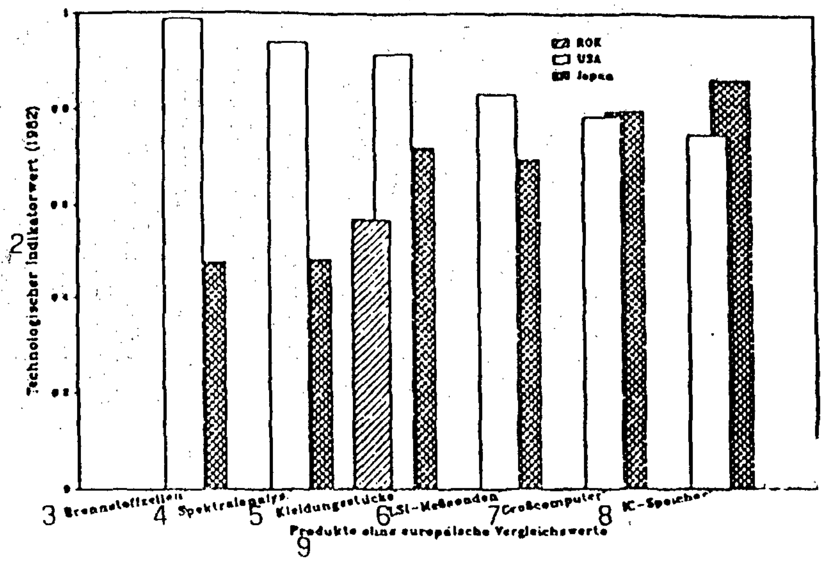
1. Figure 4.2: Technometric indicator values of the 13 technology intensive product groups with low values for the FRG (source: JATES/AIST, ISI)
2. Technology indicator value (1982)
3. Gas turbines
4. Construction plant and equipment
5. Cement
6. Electroceramics
7. Automobiles
8. PVC
9. Polyester fibers
10. Antibiotics
11. Special steel
12. Assembly robots
13. Software
14. (illegible)
15. Normal steel
16. Products with comparative values for the FRG (K* < 0.7)

1 Abb. 4.3: Technometrische Indikatorwerte für technologieintensive Produkte mit europäischen Vergleichswerten (Quelle: JATES/AIST, ISI)



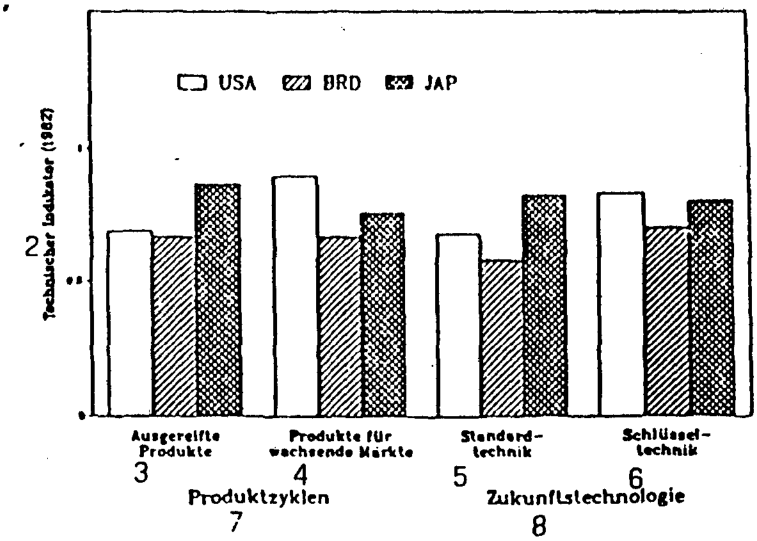
1. Figure 4.3: Technometric indicator values for technology intensive products with comparative values for Europe (source: JATES/AIST, ISI)
2. Technology indicator value (1982)
3. Theodolites
4. Urea fertilizers
5. Glass fibers
6. Civilian aircraft
7. Weaving machines
8. Semiconductor fibers
9. Radiography
10. Photocopying machines
11. Telecommunications satellites
12. Cargo ships
13. Aluminium
14. Videorecorders
15. Deep freezers
16. Products with comparative values for Europe

Abb. 4.4: Technometrische Indikatorwerte von technologieintensiven Produkten
1 ohne europäische Vergleichswerte (Quelle ⁻ES/AIST, ISI)



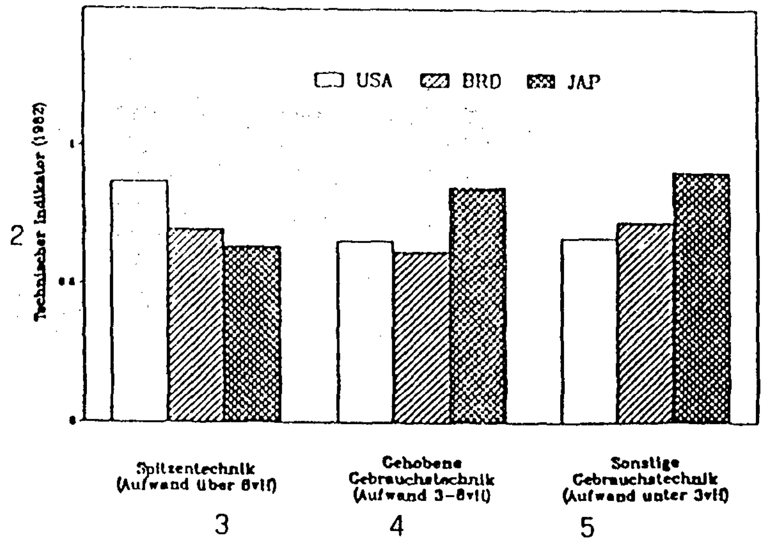
1. Figure 4.4: Technometric indicator values for technology intensive products without comparative values for Europe (source: JATES/AIST, ISI)
2. Technology indicator value (1982)
3. Fuel cells
4. Spectral analysis
5. Clothing
6. LSI sensors
7. Databanks
8. Microcomputer technology
9. Products without comparative values for Europe

Abb. 4.5: Dynamische Positionen bezuglich des technischen Leistungsstands:
1 Differentielle Betrachtung von Indikatorwerten nach Produktzyklen und Schlusseltechnologien (Indikatoren fur 1982)



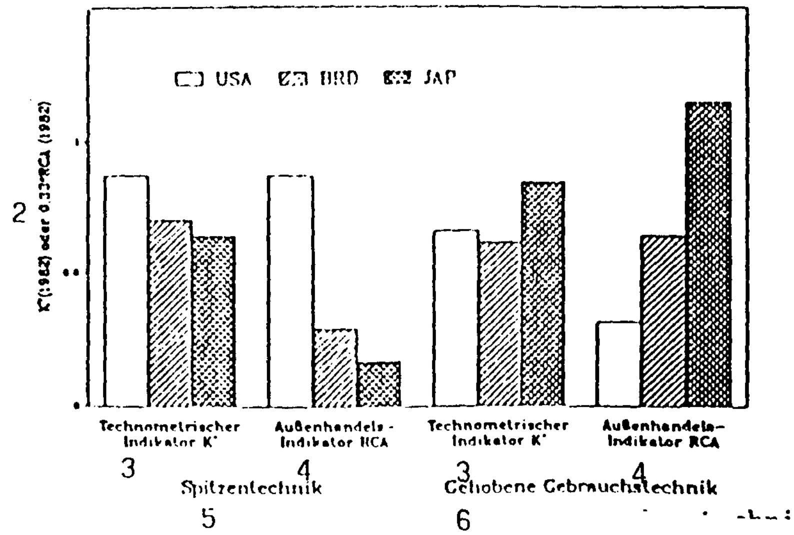
1. Figure 4.5: Dynamic positions regarding state of the art technology. differential view of indicator values according to product cycles and key technologies (indicators for 1982)
2. Technology indicator (1982)
3. Perfected products
4. Products for growth markets
5. Standard technology
6. Key technology
7. Product cycles
8. Future technology

1 Abb. 4.6: Vergleichende Technikindikatoren fur drei ausgewahlte Volkswirtschaften (zugrundeliegende Produktgruppen gemäß NIW-Technologieliste nach FuE-Intensitaten gruppiert; Daten für 1982)



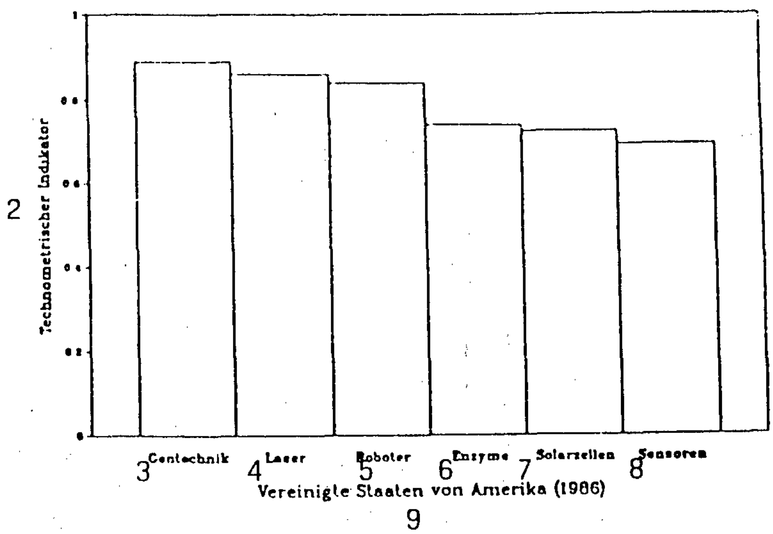
1. Figure 4.6: Comparative technology indicators for three selected national economies (based on product groups in accordance with NIW list, grouped according to R&D intensity. Data for 1982)
2. Technology indicator (1982)
3. High tech (R&D expenditure greater than 8 percent)
4. High level consumer technology (R&D expenditure 3-8 percent)
5. Other consumer technologies (R&D expenditure less than 3 percent)

1 Abb. 4.7: Vergleich von technischen und RCA-Indikatoren für das Jahr 1982 (zugrundeliegende Produktgruppen gemäß NIW-Liste nach FuE-Intensitäten gruppiert)



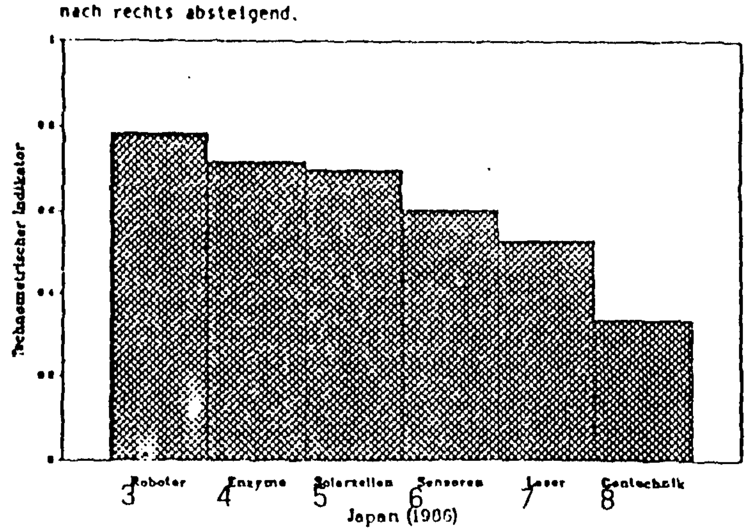
1. Figure 4.7: Comparison of technological and RCA indicators for 1982 (based on product groups in accordance with the NIW list, grouped according to R&D intensity)
2. K* (1982) or 0.33*RCA (1982)
3. Technometric indicator K*
4. Foreign trade indicator RCA
5. High tech
6. High level consumer technology

1 Abb. 4.8: Technometrische Indikatorwerte zum Stand der Technik in sechs ausgewählten Gebieten in den Vereinigten Staaten von Amerika (1986); die Anordnung erfolgt von links nach rechts absteigend.



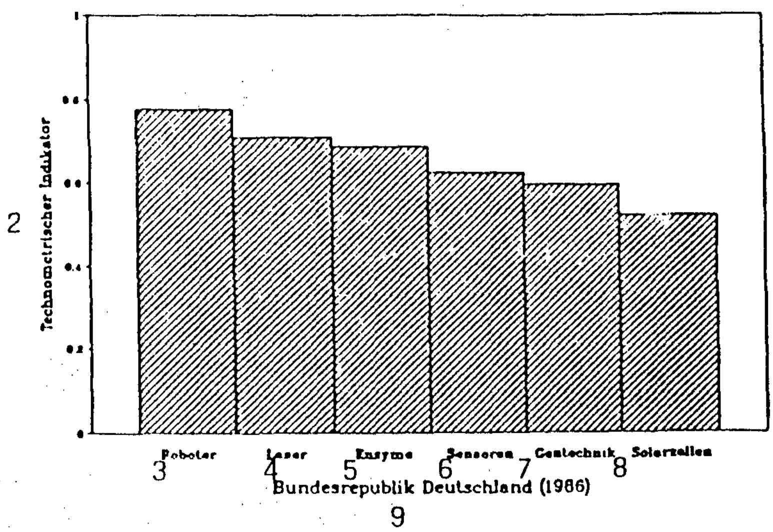
1. Figure 4.8: Technometric indicator values for state of the art technology in six selected sectors in the United States (1986). Values descending from left to right
2. Technometric indicator
3. Genetic engineering
4. Lasers
5. Robots
6. Enzymes
7. Solar cells
8. Sensors
9. United States

1 Abb. 4.9: Technometrische Indikatorwerte zum Stand der Technik in sechs ausgewählten Gebieten in Japan (1986); die Anordung erfolgt von links nach rechts absteigend.



1. Figure 4.9: Technometric indicator values for state of the art technology in six selected sectors in Japan (1986). Values descending from left to right
2. Technometric indicator
3. Robots
4. Enzymes
5. Solar cells
6. Sensors
7. Lasers
8. Genetic engineering

1 Abb. 4.10: Technometrische Indikatorwerte zum Stand der Technik in sechs ausgewählten Gebieten in der Bundesrepublik Deutschland (1986); die Anordnung erfolgt von links nach rechts absteigend.



1. Figure 4.10: Technometric indicator values for state of the art technology in six selected sectors in the FRG (1986). Values descending from left to right
2. Technometric indicator
3. Robots
4. Lasers
5. Enzymes
6. Sensors
7. Genetic engineering
8. Solar cells
9. FRG

1 Abb. 5

2	Informations- und Kommunikationstechnik	39 Felder
3	Produktions- und Automatisierungstechnik	17 "
4	Fahrzeugtechnik	16 "
5	Werkstofftechnik	15 "
6	Biotechnik, Pharmazie	14 "
7	Medizin	12 "
8	Biotechnik	11 "
9	Landtechnik	6 "
10	Umwelttechnik	6 "
11	Energietechnik	5 "
12	Sonstige	14 "

1. Figure 5
2. Information and communications technology 39 sectors
3. Production and automation technology
4. Auto technology
5. Material technology
6. Biochemistry, pharmaceuticals
7. Medicine
8. Biochemistry
9. Agricultural technology
10. Environmental technology
11. Energy technology
12. Others

8706
CSO: 3698/M001

BRIEFS

USSR, ITALIAN RAILROAD MEETING--An Italian delegation, led by the general manager of the Italian state railroad agency, Giovanni Coletti, had a series of meetings with the leaders of the Soviet railroad to increase collaboration between Italy and the USSR in this field. Also present were the director of the High-Speed Department of the railroad agency, Maurizio Cavagnaro, the vice president and managing director of Ansaldo Transporti, Emilio Maraini, and representatives of the companies involved in the Italian high-speed project. During the visit a meeting on high-speed was held in the Italian-Soviet Chamber of Commerce, sponsored by the USSR Committee for Science and Technology. On this occasion, the Soviet hosts were presented for the first time with the "Saturn Consortium" and the group of companies involved in the development of the "ETR 500" fast trains. The Saturn Consortium, composed of Ansaldo Transporti, Sirti, Sasib, Luzi, Sae, and Wabco Westinghouse, is collaborating with the state railroad in feasibility studies, draft and final designs, and production and operation of high technology railroad equipment for the Italian high-speed railroad system. The six companies have combined their technological capabilities in the traditional electric, signal, automation, telecommunications, and security sectors of passenger transportation. The ETR 500 members are part of Ansaldo Transporti, FIAT Ferroviaria, Breda, and Tibb. The meeting took place at a particularly significant time bearing in mind the new plans for the development of high-speed lines in the USSR which call for approximately 1,700 km of railroad lines. [Text] [Rome FINMECCANICA NOTTZIE in Italian No 7, 31 Jul 87 pp 3-4] 8618

CSO: 3698/M426

RESEARCH IN GDR MOLECULAR BIOLOGY INSTITUTE

East Berlin SPECTRUM in German No 3, 1987, pp 10-13

[Interview with Prof. Dr. sc.med. Charles Coutelle, Dr.med. Astrid Speer, and Dr.rer.nat. Hans-Dieter Hunger, Central Institute for Molecular Biology, by Heiner Grienitz: "Human Genetics - Humane Genetics"]

[Text] Today, approximately 3,000 genetic diseases are known. Only about 10 percent of the approximately 50,000 human genes have been identified so far. The search for diagnostic methods and--in the future--for therapies for genetic diseases as well as the mapping of the human genome are tasks at which human geneticists all over the world are working.

[Question] Your group represents molecular human genetics. What distinguishes it from the other branches of human genetics?

Prof. Coutelle: Basically, we trace back genetics to the genes, i.e. DNA. We analyse genetically determined factors based on nucleic acids. In doing so, we use a great variety of methods. Primarily methods of molecular biology. In this context, genetic engineering plays an important role.

Dr. Speer: Molecular human genetics goes back to experience and findings of classic genetics. This includes population genetics, cytogenetics, and biochemical genetics.

Prof. Coutelle: In our previous research we have been using known methods of molecular biology and genetic engineering. However, there is an increasing demand for new methods to answer the questions molecular human genetics is dealing with today: mapping of the human genome and its step-by-step sequencing.

Dr. Hunger: At present, the human genome is analyzed primarily after electrophoretic separation of the DNA which has been spliced with special enzymes. The DNA fragments thus sperated are transferred to membranous carrier materials and identified there. This method was first used by Southern (1975) who was able to transfer DNA from agarose gels to nitrocellulose filter.

Today, a worldwide search is on for high-performance carrier materials, e.g. those with a higher sensitivity.

In our department, we were able to develop such a carrier (CCA-paper). It enables us to detect a single gene from minute quantities of total human DNA. And the development of new carrier materials is only one focal area among the new methodological tasks.

Present thinking is to sequence the genes directly from the electrophoretically separated DNA without having to use the relatively expensive recombinant techniques which have been necessary previously.

[Question] What is the focus of the work done by your own group?

Prof. Coutelle: We have three. Dr. Speer and her associates work in basic biology research and are preparing to transfer their findings into medical practice. Dr. Hunger and associates work on problems of methodology, and Dr. Andre Rosenthal has been working with DNA sequencing and now wants to turn to questions of gene mapping. These three tasks cannot be neatly separated from each another; rather, they complement each other.

Dr. Speer: We are dealing with four single-gene (from one defective gene) diseases, i.e. muscular dystrophy, cystic fibrosis, phenylketonuria, and alpha1-antitryopsin deficiency.

Duchenne's sor Becker's muscular dystrophy (1 in 3,000 male births) is located on the X chromosome. Boys have one X and one Y chromosome as sex chromosomes. In girls who have two X chromosomes, with very few exceptions a tendency towards muscular dystrophy on one chromosome is compensated by the healthy X chromosome. There is no therapy for muscular dystrophy in particular, which is a progressive weakening of the muscles. In severe cases, the boys afflicted die between age 15 and 20. Possibilities for therapy are also limited for cystic fibrosis (1 in 2,000 births), a metabolic disease where all mucous glands secrete a thick mucus. Symptoms of phenylketonuria (1 in 10,000 births), also a metabolic disease where an important liver enzyme is missing, can be treated with a special diet. Without this diet, intelligence would be severely impaired and life expectancy would be reduced.

Medical application of genetic engineering methods tries to find out whether women are carriers particularly for the hereditary disease muscular dystrophy which is due to an X chromosome. In addition, we are able to do prenatal diagnosis in a number of cases. If we find that the child will have a hereditary disease, the decision to carry it to term or to abort the pregnancy rests solely with the pregnant woman and her family.

We are studying these four diseases in models and hope to be able to extend our methods to other single-gene diseases.

However, I would like to emphasize that we consider diagnosis to be only an intermediate stage. It is our goal to obtain knowledge regarding hereditary diseases so that therapies can become possible or can be improved.

[Question] What has your group achieved so far?

Prof. Coutelle: Work on these burning issues of basic research is possible only on the basis of cooperation. This is necessitated simply because of the size of our group. In the problem area of muscular dystrophy we contribute our share to international development through our cooperation with the group around Dr. Kay Davis in Oxford. In the field of cystic fibrosis we work together with Professor Williamson in London.

However, international cooperation is not a one-way street. It is based on give and take. Previously, our partner were interested in us because of the very good work the GDR does in the field of population genetics. Now we feel that we are also able to contribute interesting methodological developments.

We have had very good experience with our initial efforts to transfer our findings into medical practice on a broader scale. This is unique among the socialist countries. And also compared with capitalistic countries--which are ahead of us in some methods and which have no problems with the availability of biochemicals--we make at least our mark on the international state of transfer.

Dr. Speer: In the United States, for instance, it is possible to perform prenatal and family analyses. Commercial firms offer these services. One has to pay "only" $ 1,300 for a prenatal analysis. On the other hand, by training scientists in our techniques and by establishing several centers where these methods are mastered we are now in the process of offering these new medical possibilities without charge to those who need it. This should also be given some consideration.

Dr. Hunger: While Prof. Coutelle emphasized primarily cooperation, I would like to say that naturally there is competition between methodological developments. Here, market shares are involved, and only those prevail who participate in work which is top-level on an international scale. Based on our studies over the past five to 10 years we developed a novel, covalently binding carrier material--the cyanuric chloride activated paper (CCA)--and have shown that it is suitable for the highly sensitive detection of genetic material, particularly for prenatal analysis of minimum amounts of total DNA.

In our membranous carrier group Dr. A. Rosenthal developed a novel, carrier-dependent sequencing system based on CCA. The carrier is marketed internationally, and we hope that it will be generally accepted.

Prof. Coutelle: We are just about to formulate the documents for a transfer project. Its justification is planned for this year. According to this project, five human genetic institutions at the universities of Rostock, Greifswald, Berlin, and Leipzig as well as the Medical Academy of Magdeburg should become able to independently master the methods of molecular human genetics and to incorporate them into their counseling activities. In the past two years Dr. Speer did intensive preliminary work. In two institutions, the first cadre have already been trained.

[Question] To what extent can genetically diseases be treated today? I am thinking of gene therapies which start with the embryonic cells of the bone marrow.

Prof. Coutelle: Genetic therapy presents two problems. First, one has to have cells, which continually produce daughter cells and thus transmit the introduced gene. The death of differentiated cells with a limited life would mean that gene manipulation would also disappear again. Secondly, one has to be able to introduce a gene to the location where it fulfills its desired function.

Embryonic cells meet the first requirement. Favorites are the embryonic cells of the bone marrow which you mentioned. They provide relatively easy access and can be isolated relatively simply. In addition, we already hae a lot of experience with bone marrow transplants.

The second problem--to introduce the genes to the correct location--is much more difficult. If it is not successful, there is the danger of producing a second hereditary defect instead of healing one, or to activate a cancer gene. Work on vectors, i.e. carrier molecules which should make it possible to replace a specific defective gene with a healthy one is being done all over the world. The expectations which were placed in retroviruses only two years ago have not been fulfilled so far. Very first attempts to use the repetition sequences on both sides of the target gene are currently being made in the United States.

However, a possibly even more difficult problem than the introduction of a specific gene into the genetic material is the activation or deactivation of the gene specifically for a cell. Here, we do not even know how this works exactly.

In a first step, genetic therapy will probably be used where a gene does not have to be regulated precisely, but where it is "only" necessary to replace a certain missing or defective protein. That is to say, in the final analysis it does not matter whether the product comes from an embryonic cell of the bone marrow or from any other, constantly regenerating cell, and where an overproduction would do no harm either. This will certainly be done in the next five to ten years.

However, genetic therapy is only one treatment possibility. It will be possible to treat other diseases differently, once the basic defect has been determined.

[Question] What is your opinion on manipulation of gametes?

Prof. Coutelle: In my opinion there is no reason for manipulating gametes genetically nor do I consider this to be possible in the foreseeable future.

[Question] Do you see possibilities for genetic therapy from your own research?

Prof. Coutelle: We would like to think so. Realistically, I must say, however, that at the present we have neither the capacity nor the experience necessary. But we are following the international development and will include such projects in our future planning as well--certainly in the next five-year-plan.

[Question] Approximately 3,000 single-gene diseases are known. Can it be expected that research in human genetics will discover many more?

Dr. Speer: There might also be 5,000. I do not want to commit to a precise figure. But these are only those diseases which are caused by only one defect gene. For many more, the interaction of several genes is responsible. So far, only ten percent of all human genes have been identified as genes. That is to say that we do not yet know 90 percent. Not even their function. Certainly, they are important, too. They must also be considered as causes for disease.

[Question] In the future, we will know that many more diseases are genetically determined. Can we expect a drop in genetic diseases due to the work by you and that of your colleagues all over the world?

Prof. Coutelle: I do not think so. There are always new DNA mutations. Another problem: Three of the four diseases we examined are autosomally recessive, i.e. they depend on the random combination of two carriers for this disease. And that happens again and again, and for now we cannot change this. The carriers are not easily recognized among the population. We all are carriers for approximately 10 genetic defects.

Dr. Speer: It has to be stated very clearly: At present, we do not have a screening method which could be applied to the population to pick out carriers for genetic defects based on mass screening.

[Question] Which medical problems which are not necessarily considered to be associated with human genetics do you expect to be greatly affected by your research area in the near future?

Prof. Coutelle: Certainly, the clarification and diagnosis of certain cancer-causing factors. I am thinking of oncogenes or the influence of viral genes on the development of cancer. In addition, the methods which we are developing can certainly find much wider use in medicine. For instance, our membrane carriers can be used for the diagnosis of bacterial and viral infections and for parasitological diseases.

[Question] From our conversation so far the reader might assume that molecular human genetics deals exclusively with genetic defects. But this is not true, is it?

Prof. Coutelle: The goal of the next 20 to 50 years is the mapping of the human genome and parallel with it the start of its sequencing. Mapping is done in several steps. First, on the chromosomal level as the attribution of genetic characteristics to certain chromosomal sections. This project will be largely completed in the next two to five years. In the course of this work

more and more DNA markers of the individual genes will be located on the chromosomes. The goal is to have all genes completely sequenced in the next 50 years. But then we still will not know what effect the genes have and how they are interrelated. Therefore, research must also try to clarify these questions.

Dr. Speer: The concept of total sequencing of the human genome comes from the United States. I believe that in principle it is certainly possible to find out the nucleotide sequence of human DNA and to list it. But I consider it more imnportant to first find the remaining genes, which are not yet known at all, to identify them and to research their influence on health and disease.

Dr. Hunger: Total sequencing of the human genome, listed in the computer, does not tell much by itself. It would have to be interpreted retrospectively.

[Question] In many countries and also here in our country--I am thinking of the discussion in SINN UND FORM and of the Gatersleben meeting--warnings are being voiced regarding genetics in general, but also human genetics directly. How does that affect you?

Dr. Speer: In principle, each finding can be put to beneficial or to detrimental use. I do not believe that this is much different for genetics. What we do here in our study group is to provide knowledge and methods for genetic counseling. In Fascist Germany genetic knowledge was abused and theories of inferior genotypes, i.e. inferior human beings, were put forward. These spurious theories provided the justification for the murder of millions. We completely disassociated ourselves from this thinking here in the GDR. We provide scientific building blocks, which are used by the attending physician for genetic counseling. We adhere to the principle of absolute voluntarism, to make use of the diagnostic possibilities in molecular genetics which are being developed and to draw conclusions from them for one's own person and family. If a woman decides in favor of her handicapped child, our society supports the family and the handicapped citizen through many forms of therapy from the support for children in special kindergartens and schools to financial aid.

Dr. Hunger: I do believe that molecular human genetics has a particular responsibility. In particular, because its methods can be used very broadly. Also for areas where scientists cannot yet predict how they will develop. The development trend is towards increasingly better, more effective methods. In this context, one cannot stand aside...But the problem of misuse is primarily a political problem. And here, a responsible scientist is required to commit himself politically for the peaceful use and against misuse of his findings.

Prof. Coutelle: I followed the discussion and was also present in Gatersleben. I personally feel that the questions by the authors are legitimate: What are you doing? What effects does it have on society? We must continue the discussion and always reevaluate our own work. I said in the course of our conversation that I am against manipulation of gametes and also consider this impossible at the present stage. This is my opinion today. But this can be quite different in 50 years. New findings, new methods, and

also new ethical standards set by a society could make a scientist to represent a completely different point of view.

Never did I experience any opposition to our work in any encounter--to be sure, with selected sections of our population, i.e. with patients or parents of children with genetic diseases. On the contrary, we are experiencing great gratitude that somebody is using new methods to deal with their problems at all. Unfortunately, we are not able to do all what is expected of us. Nor did we ever hear reservations against our work from physicians.

[Interviewer] Molecular human genetics as it is done by your and other groups today, benefit mankind, it is humane genetics.

/Glossary/

DNA - linear macromolecule. Located in the cell nucleus. Consists of four different building blocks (nucletoides). The genetic information is coded in their sequence. The DNA of each human cell contains approximately 6 billion nucleotides.

Chromosomes - nucleoprotein structures which can be seen in the microscope during cell division. They contain the DNA of the cell nucleus. In humans, 24 different chromosomes can be differentiated. On each chromosme, the genes are arranged in a linear sequence.

Gene - DNA sequence which contains the information for the synthesis of a specific protein. Hereditary traits are expressed by the synthesis of proteins.

Genome - Totality of the genetic information of a species or an individual contained in DNA.

Genome Mapping - Assignment of individual DNA sections or specific genes to each other in the genome or on the chromosomes.

DNA sequencing - Determination of the nucleotide sequence of DNA.

/Photo captions/

1. p 10. Picture of an embryo. As early as during the 7th to 12th week of pregnancy, chorionic tissue (embryonic nutritive tissue) can be removed for prenatal diagnosis. Methods of molecular human genetics make it possible even today to recognize a few hereditary diseases at this early stage.

2. p 11. Photo of Dr. Astrid Speer, study group leader.

3. p 11. Photo of Prof. Dr. Charles Coutelle, department head in the Central Institute for Molecular Biology.

4. p 11. Photo of Dr. Hans-Dieter Hunger, study group leader.

5. p 12. Autoradiogram of a DNA-transfer from the membranous carrier CCA-paper developed in the Department for Molecular Human Genetics. It shows the genome analysis of a family with Duchenne's muscular dystrophy. Such band patterns make it possible to follow the genetic transmission of defective genes and possibly make a prenatal diagnosis.

12831
CSO: 2302/36

GDR INTERVIEW WITH SOVIET BIOTECHNOLOGY SPECIALIST

East Berlin URANIA in German No 2, 1987 pp 4-7

[Interview with Prof. Dr. Iuri Anatolievitsh Ovtshinnikov, Vice President of the Academy of Scienes of the USSR, by Dr. Eva Mai: "BIOGEN" as a Pacesetter--Biotechnology in the USSR]

[Text] At the meeting in connection with the 35th anniversary of the Academy of Agricultural Sciences, Prof. Dr. Iuri Anatolievitsh Ovtshinnikov, Vice President of the Academy of Sciences of the USSR was nominated as a foreign member of the Academy of Agricultural Siences. We warmly congratulated him on this honor and were glad to take this opportunity for a conversation with the scientist of the USSR. He is well known to readers of URANIA, since he commented in 1982 in our magazine on the state and perspectives of "genetic engineering".

URANIA: Comrade professor, in 1982 your discussion centered on what genetic engineering can do. Not even five years have passed, and a new discipline--biotechnology and with it the practical implementation of basic research results in genetic engineering--is gaining increasing importance. You have been appointed chief coordinator of the biotechnology program in the Soviet Union. How important is biotechnology in the Soviet economy at this stage? How do science and production cooperate?

Prof. Ovtshinnikov: Biology is attracting more and more attention. From it, we expect constantly new practical knowledge for the treatment of disease, for supplying mankind with food and for environmental protection. Biotechnology--the research, utilization, and influencing of biological processes in procedures and industrial production methods--has a high priority in the Soviet economy today. There is hardly a sector of the economy which does not benefit already from the utilization of this science--pharmacology as well as the food industry, agriculture as well as the exploitation of raw materials.

Very early on, the Communist Party of the Soviet Union and the Soviet government have strongly supported all projects in the field of biotechnology. There are three official resolutions in this regard, the last one was adopted in 1985. This refers to general biology as well as to physical-chemical biology. A new ministry for biotechnology was established which is responsible for the pharmaceutical and microbiology industry. Within the

Academy of Sciences of the USSR, biotechnology is treated as an extremely important special branch. Ten new Academy of Sciences institutes were established. They are located not only in Moscow and its surrounding area, but also in many other parts of the Soviet Union including Sibiria, the Far East, and the Ukraine.

In my opinion, biotechnology is making good progress compared to Western countries--e.g. the United States and Japan. Basic research and its results are world class. A contributing factor is that 20 percent of all research institutes in biotechnology assume top positions. The government continues to pay great attention to this scientific discipline. Take my institute--the Shemiakin Institute for the Chemistry of Bioorganic Compounds of the Academy of Sciences of the USSR-it was built completely from scratch on an area totalling 80,000 square meters. Its main fields are: explanation of protein structures, genetic engineering, membrane research, process regulation in the cell, physical methods for explaining the structure of natural products, nuclear resonance, mass spectroscopy, immunology.

At my institute we operate a pilot installation with a capacity of one million units interferon and human insulin. This installation has already become a small factory. Indeed, this is an advantage of dealing with microorganisms of biotechnology in general--minute quantities have a great impact, and no gigantic facilities are required for their production.

Recently, a completely new scientific-industrial complex was created in the USSR: BIOGEN. Here, 12 institutes of the Academy of Sciences of the USSR work together with a large industrial concern in Riga and a factory in Pustshino for biotechnology equipment. In this complex, research and production come together. This is our advantage (also in terms of time): Research and application go hand in hand. Modern biotechnology methods also involve a lot of new requirements with regard to equipment engineering. These methods are refining processes, which require equipment which must ensure maximum cleanliness, even sterile conditions. Only then is it possible to utilize the methods of genetic, enzymatic, or cell culture engineering. Therefore, these pieces of equipment must have interior surfaces which are completely smooth and meticulously clean.

Besides progress in equipment engineering, effective control of biotechnological processes under industrial conditions also requires progress in microelectronics equipment. Metabolic processes must become transparent. This involves constant analysis of each reactor content. Here, we still have a weak point: Analysis times are still too long. They must be reduced further. A process control is conceivable which makes direct use of the signals from the microorganism cells.

URANIA: Are there special training institutes for the new generation of biotechnology scientists in your country?

Prof. Ovtshinniov: You are addressing a very important question: promotion of young scientists. We plan to create a number of biotechnology centers in the USSR with the goal of conducting research and development at the most modern level, and to translate the results into practice as quickly as

possible. The training of specialists becomes increasingly more urgent. The Institute for Physiology of the Academy of Sciences of the USSR, for instance, had a decisive influence on organ, tissue, and cell culture which is so important for agriculture. Its results are used by scientists in biotechnology laboratories of leading breeding centers and agricultural research institutes. The institute provides direct theoretical and practical help in the training of young cadres.

Appropriate chairs will have to be established at the Agricultural Universities to expand and improve the training of students in genetics, molecular biology, virology, diagnostics, microbiology, and in other biological disciplines. A joint plan was prepared for the education of such specialists in the biotechnological centers and research institutes of the Academy of Sciences of, the USSR, at universities and by practical training abroad. For the time being, students who are, for instance, interested in questions of genetics and immunology work in study centers o of the Academy of Sciences of the USSR.

My institute, for example has such a study center. It is attended by students of biology, agriculture, and medicine from Moscow. Here, they can learn basic methods of biotechnology and put their knowledge to a practical test. Or another example: Recently, the new biotechnology department was established at the Physical-Technical Institute of the Academy of Sciences of the USSR in Moscow. This also includes a study group for computer technology. Here, the computer experts meet. At present, there are a total of 100 students. I myself give two lectures a week and conduct laboratory sessions in biotechnology. The lecture cycle goes over two years. The most modern equipment is available, the most advanced methods are being taught. I accept 25 students per year in my institute as scientific associates once they passed their examinations. They are already top scientists who help promote progress in biotechnology. We have the same thing in the Ukraine, in Novosibirsk, and in other republics of the Union.

URANIA: How do you assess the utilization of biotechnology methods and to what extent are they being used, for instance, for the production of feed protein or in the breeding of cultivated plants?

Prof. Ovtshinnikov: As to the utilization of basic technologies we have initial results in cultivated plant research, e.g. in the use of cell and tissue cultivation, in human medicine, in animal breeding. Genetic engineering is being used more and more. Today, the science-production association BIOGEN is already in operation! However, in the field of applied research, activities must be intensified, and studies must be speeded up for the benefit of medicine and agriculture. The problem of microbiological protein extraction is very important for agriculture. The USSR has initiated the process towards increasing the capacities in industrial microbiolgy which is already now in first place worldwide with regard to production volume. In the near future, this industry is supposed to ensure an increase of feed protein production.

Another possibility is the manipulation of plant species with the aim of finding types which will produce large amounts of proteins. The Institute for

Plant Physiology and the Institute for General Genetics of the Academy of Sciences of the USSR as well as the Institute for Botany of the Academy of Sciences of the Ukrainian SSR are working successfully on these problems.

Legumes live in symbiosis with bacteria which have the ability to oxidize nitrogen from air. At present, work is being done in the transfer of genes which code the nitrogen binding from air, to other cultivated plant species--e.g. of wheat.

In addition to protecting cultivated plants and working animals against disease, the problems of diagnosis, in particular diagnosis of viral diseases, is very important. The Academy of Sciences of the Estonian SSR obtained interesting results in this field. They worked out a method for the serological diagnosis of viruses in plants with the help of monoclonal antibodies.

Particular attention is being paid to the development of efforts which ensure the mass use of biological preparations to fight pests and diseases of agricultural useful plants. The arsenal of available means is still insufficient. On the other hand, an extensive production experiment using the biological method for the cotton supply of Usbekistan and other Central Asian republics showed the high ecological effectiveness of biopreparations under the conditions in these areas.

URANIA: What priority do you give research cooperation of biotechnologists in particular in the field of agriculture within your country, within CMEA-countries, and bilaterally with the GDR?

Prof. Ovtshinnikov: It is important to train the new generation of researchers which is coming up in such a way that they will be able to solve highly complicated problems of agricultural production using biotechnology. One of the most important requirements for this is the close, creative relationship between the Academy of Sciences of the USSR and the Lenin Academy of Agricultural Sciences of the USSR; in addition, cooperation with the Academies of the GDR and other Socialistic countries is very important. Incidentally, the GDR is the most important partner of the USSR in the field of biotechnology. This applies to basic research and application in agriculture, medicine, and industrial microbiology. I consider the cooperation between the scientific institutions of our two countries to be very good, the scientific level of both partners is very high. I was able to see this for myself during my visit to institutes of the Academy of Agricultural Sciences of the GDR. They use the most modern methods. I am convinced: We have gained sufficient knowledge in basic research--now it is a matter of fast practical implementation. Here, too, we are glad to make use of the experience of our colleagues in the GDR. Our cooperation is becoming increasingly closer.

Many problems in agriculture in the USSR cannot be solved easily: Consider the great variety of climatic zones, the frequently extreme conditions--I only want to mention Kasachstan as an example, where newly cultivated land has been used extensively so far, and now must be used increasingly more intensively! Each republic in the Union has its special climatic and soil conditions. It

is, for instance, important to work on specific germs for specific species. Models are of little use here. What counts is the practical test. In this respect, research cooperation among all CMEA-countries is very important. The CMEA-complex program must be implemented as efficiently as possible. There is still too much paper pushing. In the future, work should be targeted even more to specific subjects with the cooperation of the respective experts.

Of course, there is enormous competition in Western countries in the field of biotechnology. There, biotechnology results are finding more and more commercial applications. Nevertheless, the partners USSR/GDR have the opportunity to influence the world level. The achievements of our two countries in the field of biotechnology made so far are part of the bi- or multilateral CMEA-cooperation of the Socialist countries. When implementing the CMEA-complex program, a document which reaches far into the year 2000, it is important to utilize all advantages of the socialist economic integration, i.e. the individual countries must continue to develop and strengthen specialization and cooperation in the fields of science, technology, and production, and must use the available scientific and technical achievements of their countries even more comprehensively and more effectively.

URANIA: Comrade professor, we thank you for this informative conversation.

12831
CSO: 2302/34

END

10

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, economic, military, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available source; it should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated. Those from English-language sources are transcribed, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [ ] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names which are rendered phonetically or transliterated by FBIS/JPRS are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in 8 volumes: China, East Europe, Soviet Union, East Asia, Near East & South Asia, Africa (Sub-Sahara), Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications generally contain less time-sensitive information and are published periodically. Current JPRS publications are listed in *Government Reports Announcements* issued semi-monthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcovers or microfiche) at no charge through their sponsoring organizations. DOD consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.) For additional information or assistance, call FBIS, (703) 527-2368, or write to P.O. Box 2604, Washington, D.C. 20013.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. New subscribers should expect a 30-day delay in receipt of the first issue.

Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.